



CALL NO. 100

CONTRACT ID. 071226

JEFFERSON COUNTY

FED/STATE PROJECT NUMBER NH 265-3 (018)

LETTING DATE: September 7, 2007

Sealed Bids will be received in the Division of Construction Procurement and/or the Auditorium located on the 1st floor of the Transportation Cabinet Office Building until 10:00 AM EASTERN DAYLIGHT TIME September 7, 2007. Bids will be publicly opened and read at 10:00 AM EASTERN DAYLIGHT TIME.

ROAD AND/OR BRIDGE PLANS

DBE CERTIFICATION REQUIRED

REQUIRED BID PROPOSAL GUARANTY: Not less than 5% of the total bid.

(Check guaranty submitted: Cashier's Check Certified Check Bid Bond)

BID BONDS WHEN SUBMITTED WILL BE RETAINED WITH THE PROPOSAL

DBE General Plan Included

BID

PROPOSAL ISSUED TO: _____

SPECIMEN

Address

City

State

Zip

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PART I
SCOPE OF WORK

CONTRACT ID - 071226

ADMINISTRATIVE DISTRICT - 05

PROJECT(S) IDENTIFICATION AND DESCRIPTION:

COUNTY - JEFFERSON
NH 265-3 (018)

PCN - DE0560NEW07W1

LSIORPB SECTION 4B EXPLORATORY TUNNEL LOUISVILLE BRIDGES; SECTION FOUR-EAST END BRIDGE
APPROACH DESIGN, A DISTANCE OF 0.76 MILES. GRADE & DRAIN. SYP NO. 05-00731.00.
GEOGRAPHIC COORDINATES LATITUDE 38^19'00" LONGITUDE 85^37'00"

COMPLETION DATE(S) AND LIQUIDATED DAMAGES ESTABLISHED:

COMPLETION DATE - June 15, 2009

APPLIES TO ENTIRE CONTRACT

SEE SPECIAL NOTES FOR LIQUIDATED DAMAGES

CONTRACT NOTES

PROPOSAL ADDENDA

All addenda to this proposal must be incorporated into the proposal when the bid is submitted to the Kentucky Department of Highways. Failure to use the correct and most recent bid sheet(s) may result in the bid being rejected.

BID SUBMITTAL

Bidder must use the Department's Highway Bid Program available on the Internet web site of the Department of Highways, Division of Construction Procurement. (www.transportation.ky.gov/contract)

The Bidder must download the bid items created from the web site to prepare a bid proposal for submission to the Department. The bidder must insert the completed bid item sheets printed from the Program into the bidder's proposal and submit with the disk created by said program.

JOINT VENTURE BIDDING

Joint Venture bidding is permissible. However, both companies MUST purchase a bidding proposal. Either proposal may be submitted but must contain the company names and signatures of both parties where required. A joint bid bond of 5% may be submitted for both companies or each company may submit a separate bond of 5%.

UNDERGROUND FACILITY DAMAGE PROTECTION

The contractor is advised that the Underground Facility Damage Protection Act of 1994, became law January 1, 1995. It is the contractor's responsibility to determine the impact of the act regarding this project, and take all steps necessary to be in compliance with the provision of the act.

CONTRACT DBE GOAL

The Disadvantaged Business Enterprise (DBE) goal established for this contract is 1 % of the total value of the contract.

The contractor shall exercise all necessary and reasonable steps to ensure that Disadvantaged Business Enterprises participate in at least the percent of the contract as set forth above as goals for this contract.

FEDERAL CONTRACT NOTES

The Kentucky Department of Highways, in accordance with the Regulations of the United States Department of Transportation 23 CFR 635.112 (h), hereby notifies all bidders that failure by a bidder to comply with all applicable sections of the 2004 Kentucky Standard Specifications, including, but not limited to the following, may result in a bid not being considered responsive and thus not eligible to be considered for award:

102.02 Current Capacity Rating
102.08 Irregular Proposals
102.09 Proposal Guaranty

102.10 Delivery of Proposals
102.14 Disqualification of Bidders

CIVIL RIGHTS ACT OF 1964

The Kentucky Department of Highways, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252) and the Regulations of the Federal Department of Transportation (49 C.F.R., Part 21), issued pursuant to such Act, hereby notifies all bidders that it will affirmatively insure that the contract entered into pursuant to this advertisement will be awarded to the lowest responsible bidder without discrimination on the ground of race, color, or national origin.

NOTICE TO ALL BIDDERS

To report bid rigging activities call: 1-800-424-9071.

The U.S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m. eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

FHWA 1273

The requirements of Paragraph VI of FHWA 1273 does not apply to projects with a total cost of less than \$1,000,000.00.

SECOND TIER SUBCONTRACTS

Second Tier subcontracts on federally assisted projects shall be permitted. However, in the case of DBE's, second tier subcontracts will only be permitted where the other subcontractor is also a DBE. All second tier subcontracts shall have the consent of both the Contractor and the Engineer.

DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

It is the policy of the Kentucky Transportation Cabinet (“the Cabinet”) that Disadvantaged Business Enterprises (“DBE”) shall have the opportunity to participate in the performance of highway construction projects financed in whole or in part by Federal Funds in order to create a level playing field for all businesses who wish to contract with the Cabinet. To that end, the Cabinet will comply with the regulations found in 49 CFR Part 26, and the definitions and requirements contained therein shall be adopted as if set out verbatim herein.

The Cabinet, contractors, subcontractors, and sub-recipients shall not discriminate on the basis of race, color, national origin, or sex in the performance of work performed pursuant to Cabinet contracts. The contractor shall carry out applicable requirements of 49 CFR 26 in the award and administration of federally assisted highway construction projects. The contractor will include this provision in all its subcontracts and supply agreements pertaining to contracts with the Cabinet.

Failure by the contractor to carry out these requirements is a material breach of its contract with the Cabinet, which may result in the termination of the contract or such other remedy as the Cabinet deems necessary.

OBLIGATION OF CONTRACTORS

Each contractor prequalified to perform work on Cabinet projects shall designate and make known to the Cabinet a liaison officer who is assigned the responsibility of effectively administering and promoting an active program for utilization of DBEs.

If a formal goal has not been designated for the contract, all contractors are encouraged to consider DBEs for subcontract work as well as for the supply of material and services needed to perform this work.

Contractors are encouraged to use the services of banks owned and controlled by minorities and women.

CERTIFICATION OF CONTRACT GOAL

Contractors shall include the following certification in bids for projects for which a DBE goal has been established. BIDS SUBMITTED WHICH DO NOT INCLUDE CERTIFICATION OF DBE PARTICIPATION WILL NOT BE READ PUBLICLY. These bids will not be considered for award by the Cabinet and they will be returned to the bidder.

“The bidder certifies that it has secured participation by Disadvantaged Business Enterprises (“DBE”) in the amount of ____ percent of the total value of this contract and that the DBE participation is in compliance with the requirements of 49 CFR 26 and the policies of the Kentucky Transportation Cabinet pertaining to the DBE Program.”

The certification statement is located on the last page of this proposal. All contractors must certify their DBE participation on that page. DBEs utilized in achieving the DBE goal must be certified and prequalified for the work items at the time the bid is submitted.

DBE PARTICIPATION PLAN

All bidders are encouraged to submit their General DBE Participation Plan with their bid on the official form. Lowest responsive bidders whose bid packages include DBE Participation Plans may be awarded the contract at the next Awards Committee meeting provided that the DBE goal is met. The DBE Participation Plan shall include the following:

1. Name and address of DBE Subcontractor(s) and/or supplier(s) intended to be used in the proposed project;
2. Description of the work each is to perform including the work item , unit, quantity, unit price and total amount of the work to be performed by the individual DBE;
3. The dollar value of each proposed DBE subcontract and the percentage of total project contract value this represents. DBE participation may be counted as follows:
 - a) If DBE suppliers and manufactures assume actual and contractual responsibility, the dollar value of materials to be furnished will be counted toward the goal as follows:
 - The entire expenditure paid to a DBE manufacturer;
 - 60 percent of expenditures to DBE suppliers that are not manufacturers provided the supplier is a regular dealer in the product involved. A regular dealer must be engaged in, as its principal business and in its own name, the sale of products to the public, maintain an inventory and own and operate distribution equipment; and
 - the amount of fees or commissions charged by the DBE firms for a bona fide service, such as professional, technical, consultant, or managerial services and assistance in the procurement of essential personnel, facilities, equipment, materials, supplies, delivery of materials and

- supplies or for furnishing bonds, or insurance, providing such fees or commissions are determined to be reasonable and customary.
- b) The dollar value of services provided by DBEs such as quality control testing, equipment repair and maintenance, engineering, staking, etc.;
 - c) The dollar value of joint ventures. DBE credit for joint ventures will be limited to the dollar amount of the work actually performed by the DBE in the joint venture;
4. Written and signed documentation of the bidder's commitment to use a DBE contractor whose participation is being utilized to meet the DBE goal; and
 5. Written and signed confirmation from the DBE that it is participating in the contract as provided in the prime contractor's commitment.

The apparent low bidder who does not submit a General DBE Participation Plan with the bid shall submit it within 10 calendar days after receipt of notification that they are the apparent low bidder. The project will not be considered for award prior to submission and approval of the apparent low bidder's DBE Participation Plan.

Detailed DBE Participation Plan forms will be included in the Contractor Package presented to successful bidders following the awarding of the project. The Detailed DBE Participation Plan must be completed and returned to Contract Procurement in accordance with Cabinet policy. A copy of the blank estimate will be included with the Detailed DBE Participation Plan to list sequence items by PCN (Project Control Number).

Changes to DBE Participation Plans must be approved by the Cabinet. The Cabinet may consider extenuating circumstances including, but not limited to, changes in the nature or scope of the project, the inability or unwillingness of a DBE to perform the work in accordance with the bid, and/or other circumstances beyond the control of the prime contractor.

CONSIDERATION OF GOOD FAITH EFFORTS REQUESTS

If the DBE participation submitted in the bid by the apparent lowest responsive bidder does not meet or exceed the DBE contract goal, the apparent lowest responsive bidder must submit a Good Faith Effort Package to satisfy the Cabinet that sufficient good faith efforts were made to meet the contract goals prior to submission of the bid. Efforts to increase the goal after bid submission will not be considered in justifying the good faith effort, unless the contractor can show that the proposed DBE was solicited prior to the letting date. DBEs utilized in achieving the DBE goal must be certified and prequalified for the work items at the time the bid is submitted. One complete set and nine (9) copies of this information must be received in the office of the Division of Contract Procurement no later than 12:00 noon of the tenth calendar day after receipt of notification that they are the apparent low bidder.

Where the information submitted includes repetitious solicitation letters it will be acceptable to submit a sample representative letter along with a distribution list of the firms solicited. Documentation of DBE quotations shall be a part of the good faith effort

submittal as necessary to demonstrate compliance with the factors listed below which the Cabinet considers in judging good faith efforts. This documentation may include written subcontractors' quotations, telephone log notations of verbal quotations, or other types of quotation documentation.

The Good Faith Effort Package shall include, but may not be limited to information showing evidence of the following:

1. Whether the bidder attended any pre-bid meetings that were scheduled by the Cabinet to inform DBEs of subcontracting opportunities;
2. Whether the bidder provided solicitations through all reasonable and available means;
3. Whether the bidder provided written notice to all DBEs listed in the DBE directory at the time of the letting who are prequalified in the areas of work that the bidder will be subcontracting;
4. Whether the bidder followed up initial solicitations of interest by contacting DBEs to determine with certainty whether they were interested. If a reasonable amount of DBEs within the targeted districts do not provide an intent to quote or no DBEs are prequalified in the subcontracted areas, the bidder must notify the DBE Liaison in the Office of Minority Affairs to give notification of the bidder's inability to get DBE quotes;
5. Whether the bidder selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the contract goals. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the prime contractor might otherwise perform these work items with its own forces;
6. Whether the bidder provided interested DBEs with adequate and timely information about the plans, specifications, and requirements of the contract;
7. Whether the bidder negotiated in good faith with interested DBEs not rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities. Any rejection should be so noted in writing with a description as to why an agreement could not be reached;
8. Whether quotations were received from interested DBE firms but were rejected as unacceptable without sound reasons why the quotations were considered unacceptable. The fact that the DBE firm's quotation for the work is not the lowest quotation received will not in itself be considered as a sound reason for rejecting the quotation as unacceptable. The fact that the bidder has the ability and/or desire to perform the contract work with its own forces will not be considered a sound reason for rejecting a DBE quote. Nothing in this provision shall be construed to require the bidder to accept unreasonable quotes in order to satisfy DBE goals;
9. Whether the bidder specifically negotiated with subcontractors to assume part of the responsibility to meet the contract DBE goal when the work to be subcontracted includes potential DBE participation;
10. Whether the bidder made any efforts and/or offered assistance to interested DBEs in obtaining the necessary equipment, supplies, materials, insurance and/or bonding to satisfy the work requirements of the bid proposal; and

11. Any other evidence that the bidder submits which may show that the bidder has made reasonable good faith efforts to include DBE participation.

FAILURE TO MEET GOOD FAITH REQUIREMENT

Where the apparent lowest responsive bidder fails to submit sufficient participation by DBE firms to meet the contract goal and upon a determination by the Good Faith Committee based upon the information submitted that the apparent lowest responsive bidder failed to make sufficient reasonable efforts to meet the contract goal, the bidder will be offered the opportunity to meet in person for administrative reconsideration. The bidder will be notified of the Committee's decision within 24 hours of its decision. The bidder will have 24 hours to request reconsideration of the Committee's decision. The reconsideration meeting will be held within two days of the receipt of a request by the bidder for reconsideration.

The request for reconsideration will be heard by the Office of the Secretary. The bidder will have the opportunity to present written documentation or argument concerning the issue of whether it met the goal or made an adequate good faith effort. The bidder will receive a written decision on the reconsideration explaining the basis for the finding that the bidder did or did not meet the goal or made adequate Good Faith efforts to do so.

The result of the reconsideration process is not administratively appealable to the Cabinet or to the United States Department of Transportation.

The Cabinet reserves the right to award the contract to the next lowest responsive bidder or to rebid the contract in the event that the contract is not awarded to the low bidder as the result of a failure to meet the good faith requirement.

SANCTIONS FOR FAILURE TO MEET DBE REQUIREMENTS OF THE PROJECT

Failure by the prime contractor to fulfill the DBE requirements of a project under contract or to demonstrate good faith efforts to meet the goal constitutes a breach of contract. When this occurs, the Cabinet will hold the prime contractor accountable, as would be the case with all other contract provisions. Therefore, the contractor's failure to carry out the DBE contract requirements shall constitute a breach of contract and as such the Cabinet reserves the right to exercise all administrative remedies at its disposal including, but not limited to the following:

- Disallow credit toward the DBE goal;
- Withholding progress payments;
- Withholding payment to the prime in an amount equal to the unmet portion of the contract goal; and/or
- Termination of the contract.

PROMPT PAYMENT

The prime contractor will be required to pay the DBE within seven (7) working days after he or she has received payment from the Kentucky Transportation Cabinet for work performed or materials furnished.

CONTRACTOR REPORTING

All contractors must keep detailed records and provide reports to the Cabinet on their progress in meeting the DBE requirement on any highway contract. These records may include, but shall not be limited to payroll, lease agreements, cancelled payroll checks, executed subcontracting agreements, etc. Prime contractors will be required to submit certified reports on monies paid to each DBE subcontractor or supplier utilized to meet a DBE goal.

Prime contractors will incorporate a requirement into DBE subcontracts, including supply contracts, that DBEs must provide to the Division of Construction, a copy of all checks received from the prime contractor within seven days of receipt of payment for work performed on Cabinet projects. Checks to DBE subcontractors must include the PCN number, estimate number, and the sequence and quantity.

DEFAULT OR DECERTIFICATION OF THE DBE

If the DBE subcontractor or supplier is decertified or defaults in the performance of its work, and the overall goal cannot be credited for the uncompleted work, the prime contractor may utilize a substitute DBE or elect to fulfill the DBE goal with another DBE on a different work item. If after exerting good faith effort in accordance with the Cabinet's Good Faith Effort policies and procedures, the prime contractor is unable to replace the DBE, then the unmet portion of the goal may be waived at the discretion of the Cabinet.

TRAINEES

In Compliance with the "TRAINING SPECIAL PROVISION" included in Part III of the Proposal, the Contractor will be required to employ 1 trainee(s) (Truck Driver) for this contract.

ASPHALT MIXTURE

The rate of application for all asphalt mixtures shall be estimated at 110 lbs/sy per inch of depth, unless otherwise noted.

FUEL AND ASPHALT PAY ADJUSTMENT

These contract items Lot Pay Adjustment, Asphalt Adjustment and Fuel Adjustment, are for possible future payments. Additional monies may need to be setup with an additional change order if existing contract amount is insufficient to pay all items on the contract. Unit price is \$1.00. Quantity will be actual adjustment after work is completed.

LOUISVILLE- SOUTHERN INDIANA OHIO RIVER BRIDGES PROJECT

SECTION 4B: EXPLORATORY TUNNEL AND ACCESS RAMP

JEFFERSON COUNTY

Exploratory Tunnel and Access Ramp Special Notes



Prepared For:

**Kentucky Transportation Cabinet
Department of Highways**

EXPLORATORY TUNNEL AND ACCESS RAMP SPECIAL NOTES LIST OF CONTENTS

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JEFFERSON COUNTY
NH-2653 (018)
Louisville-Southern Indiana Ohio River Bridges Project (LSIORBP)
Section 4B- Exploratory Tunnel and Access Ramp
ITEM NO. 5-731.00

The following companies have facilities to be adjusted and/or relocated on subject project.

Louisville Gas & Electric Company- Overhead Electric

The Electric Company has existing overhead facilities on the west side of U.S. 42 which will be utilized to service the project. The Electric Company will install a pole in the southwest corner of the contractor's worksite at approximate Sta. 15+10 150ft Rt of the Access Ramp., and a pad mounted transformer at approximate Station 15+00 140ft Rt. of the Access Ramp. The Electric Company will connect to the transmission lines on the west side of U.S. 42, span U.S. 42 to the installed pole, run lines through the new conduit, and terminate the connections to the transformer. The Electric Company also has a guy pole located in the vicinity of the proposed water main extension at approximate Station 22+00 Rt. of U.S. 42. The guy pole is not to be disturbed. The work described herein is expected to be completed by July 22, 2007. (Greg Geiser 4-4-07)

Bellsouth Telecommunication- Overhead Telephone

The overhead telephone is located on the west side of U.S. 42, with one pole on the east side of U.S. 42. This pole is located in the vicinity of the proposed water main at approximate Station 21+00 Rt. of U.S. 42. The pole is not to be disturbed. No relocations or conflicts are anticipated.

Insight Communications- Overhead Cable Television

Overhead facilities are located on the LG&E poles located on the west side of U.S. 42. No relocations or conflicts are anticipated.

Level 3 (Formerly Wiltel) Communications- Underground Fiber Optic

Underground fiber optic facilities are located on the west side of U.S. 42 within 1 to 3 feet of the right of way fence. No relocations or conflicts are anticipated.

T-Mobile Cellular

T-Mobile facilities are located on the west side of U.S. 42 near the LG&E pole route. No relocations or conflicts are anticipated.

Louisville Water Company

There are no existing water main facilities in the project area. A water main extension is included as part of the roadway contract. The extension involves a 12" DIP Main, which will be constructed from Wolf Pen Branch Road, along the east side of U.S. 42, to within 150ft of the south portal of the exploratory tunnel.

Metropolitan Sewer District

No facilities in the Project area.

Louisville Gas and Electric Company- Gas

No facilities in the Project area.

PROTECTION OF UTILITIES

The location of utilities provided in the contract documents has been furnished by the facility owners and/or by reviewing record drawings and may not be accurate. It will be the roadway contractor's responsibility to locate utilities before excavating by calling the various utility owners and by examining any supplemental information supplied by the cabinet. If necessary, the roadway contractor shall determine the exact location and elevation of utilities by hand digging to expose utilities before excavating in the area of a utility. The cost for repair and any other associated costs for any damage to utilities caused by the roadway contractor's operations shall be borne by the roadway contractor.

The contractor should exercise extra caution when working in the vicinity of any existing ITS – Components on this project, it will be the contractor's responsibility to contact and coordinate with the appropriate utility company for service to their facility. All overhead and underground installation should also be coordinated so as not to cause conflict with any other utility.

The Contractor is advised to contact BUD one-call system; however, the Contractor should be aware that owners of underground facilities are not required to be members of the BUD one-call system. It may be necessary for the Contractor to contact the County Court Clerk to determine what utility companies have facilities in the project area.

Note:

The Contractor is advised to contact the BUD one-call system; however, the Contractor should be aware that not all owners may be a member of the BUD one-call system.

Call Before You Dig (BUD) 1-800-752-6007

Jefferson County
NH-2653 (018)
Item No. 5-731.00
Exploratory Tunnel and Access Ramp

SPECIAL NOTE FOR PROJECT MANAGEMENT

The Contractor is advised that this project is part of the overall Louisville-Southern Indiana Ohio River Bridges Project (LSIORBP). The intent of this contract, which includes an Exploratory Tunnel and Access Ramp, is to facilitate the geotechnical and design work associated with the proposed tunnels to be built as part of the LSIORBP.

As stipulated in the Federal Highway Administration's (FHWA) Record of Decision (ROD) for the LSIORBP, authority of oversight and management of this work is granted to the Bi-State Management Team (BSMT), consisting of officials from the Kentucky Transportation Cabinet (KYTC), Indiana Department of Transportation (INDOT), and the FHWA.

Coordination with the BSMT for the review and approval of any major changes or deviations from the plans or contract documents shall be required. This would include, but is not limited to: all change orders, Value Engineering (VE) proposals, maintenance of traffic proposals, project phasing changes, and plan changes that may have environmental or historical impacts or effects.

Jefferson County
NH-2653 (018)
Item No. 5-731.00
Exploratory Tunnel and Access Ramp

SPECIAL NOTE FOR MANDATORY PRE-BID CONFERENCE

A mandatory Pre-Bid Conference for the Exploratory Tunnel and Access Ramp project has been scheduled for Tuesday, July 31, 2007 at 9:00 a.m. Eastern time. The Pre-Bid Conference will be held at the KYTC Office Building Auditorium located at 200 Mero Street in Frankfort, KY.

Jefferson County
NH-2653 (018)
Item No. 5-731.00
Exploratory Tunnel and Access Ramp

SPECIAL NOTE FOR FORMAL PARTNERING

Pursuant to Subsection 114.02 of the Kentucky Transportation Cabinet, Department of Highway's 2004 *Standard Specifications for Road and Bridge Construction*, Formal Partnering shall be utilized to assist in the administration of this project. In addition to the stipulations of Formal Partnering, which include a facilitated team building workshop and regularly scheduled partnering meetings, it is the intent that the Contractor and the Department may jointly discuss and agree to items such as:

1. An Issues Escalation Ladder, which may be used to define roles and responsibilities of partnering team members, to help define and resolve issues as they may arise, and to aid in decisions being made at the appropriate level and with consideration to time.
2. Development of a voluntary dispute resolution methodology.
3. Project Schedule coordination and development.
4. A public involvement program.
5. Identification of other shared stakeholder responsibilities.
6. Development of shared stakeholder goals.

Project stakeholders to be included in the partnering process shall include, but are not limited to, the Department's and the Contractor's key on-site personnel, mid-level management, and upper level management. Other stakeholders in the partnering process shall be members of the Bi-State Management Team, FHWA, the Project's General Engineering Consultant (GEC), and the Project Section Design Consultant (H.W. Lochner, Inc.), and all sub-contractors.

The Contractor and the Department may mutually agree to identify and invite other stakeholders to the Team Building Workshop. These other stakeholders may include suppliers, utility company representatives, local government officials, or representatives of local neighborhoods.

Measurement and Payment

All costs associated with developing and maintaining a Formal Partnership will be agreed to by both parties and will be shared equally. The Department will pay 50% of the cost to develop and maintain this Formal Partnership. The Contractor shall submit to the Engineer all invoices for costs associated with Formal Partnering.

Jefferson County
NH-2653 (018)
Item No. 5-731.00
Exploratory Tunnel and Access Ramp

SPECIAL NOTE FOR FIXED COMPLETION DATE

The Contractor is advised that this project is part of the overall Louisville-Southern Indiana Ohio River Bridges Project (LSIORBP). The intent of this contract, which includes an Exploratory Tunnel and Access Ramp, is to facilitate the geotechnical and design work associated with the proposed tunnels to be built as part of the LSIORBP.

The Work includes two phases:

- Phase I - The construction of the Access Ramp, the construction of the Exploratory Tunnel, and the required geotechnical and geophysical investigations
- Phase II - The maintenance and protection phase as defined in the Special Note for Maintenance and Protection of Project Site

The Engineer shall determine the date on which Phase I of the Work is complete and issue a Project Completion Notice in accordance with Sub-section 105.12 of the Department's 2004 *Standard Specifications for Road and Bridge Construction* to inform the Contractor in writing of the date of commencement of the maintenance period.

In accordance with Sub-section 108.07.04 of the Department's 2004 *Standard Specifications for Road and Bridge Construction*, **Phase I of this project has a fixed completion date of June 15, 2009**. Contrary to Sub-section 108.09, liquidated damages will be charged during the months of December through March for all construction work not complete. Contrary to Sub-section 108.09, the liquidated damages will be charged during those periods when seasonal limitations of the Contract prohibit the Contractor from working on a controlling item or operation.

A time extension for Phase I of this project will not be permitted. Weather will not be considered an exception. For each calendar day construction continues past June 15, 2009, liquidated damages at the rate of \$1600 per day will be assessed. There is no cap for liquidated damages for this project.

For the completion date for Phase II, refer to the Special Note for Maintenance and Protection of Project Site.

Jefferson County
NH-2653 (018)
Item No. 5-731.00
Exploratory Tunnel and Access Ramp

SPECIAL NOTE FOR PROJECT IDENTIFICATION SIGNS

The Contractor shall install Department-furnished Project Identification Signs at the project limits. The signs shall be approximately 44" x 72" or 72" x 120" aluminum sign blanks with standard color reflection sheeting with the applicable county and project names affixed. The Engineer shall determine the size and location of the signs to be used on the project.

The Contractor shall pick up the signs at the District Traffic Operations Facility. The Contractor shall furnish posts and hardware for mounting the signs and maintain the signs during the duration of the project. Upon completion of the work, the Contractor shall remove the signs and return them to the District Traffic Operations Facility. The posts and mounting hardware remain the property of the Contractor.

The Engineer shall measure installation of the Project Identification Signs in individual units of Each. Payment at the contract unit price for Each shall be full compensation for all labor, materials, equipment, and incidentals required for picking up, installing, maintaining, uninstalling, and returning the Project Identification Signs to the District Traffic Operations Facility.

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
20588NC	Install Project Identification Signs	Each

Jefferson County
NH-2653 (018)
Item No. 5-731.00
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SPECIAL NOTE FOR CONSTRUCTION WORKING HOURS AND RESTRICTIONS

Construction activities shall not be allowed during the following dates:

November 22-25, 2007 (Thanksgiving)
December 22-25, 2007 (Christmas)

Transporting material outside the project limits or other activities directly impacting traffic shall not be allowed during the following dates:

May 3, 2008 (Kentucky Derby)
May 24-26, 2008 (Memorial Day)
July 4-6, 2008 (Independence Day)
August 30 –September 1, 2008 (Labor Day)
September 16 – September 21, 2008 (Ryder Cup)
November 27-30, 2008 (Thanksgiving)
December 24-26, 2008 (Christmas)
May 2, 2009 (Kentucky Derby)
May 23-25, 2009 (Memorial Day)

Except for dates noted above, the hours of construction for the Access Ramp are from 7:00 a.m. to 7:00 p.m. Monday through Friday and from 9:00 a.m. to 5:00 p.m. on Saturday unless the Engineer gives written authorization otherwise. Construction shall not be allowed on Sunday unless the Engineer gives written authorization.

Hours of construction for the Exploratory Tunnel may be expanded to twenty-four (24) hours a day, seven (7) days a week providing there is adherence to the “Special Note for Blasting and Vibration.” The Engineer may at any time, upon providing written notification to the Contractor, restrict the hours of construction for the Exploratory Tunnel.

Inspection, geophysical survey, survey, tunnel photographic survey, probe drilling, exploration probe drilling, exploratory borings with core recovery, and geotechnical monitoring activities by the Contractor may be permitted with the approval of the Engineer at any time.

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SPECIAL NOTE FOR CONSTRUCTION STAGING AND NO WORK ZONES

All construction staging for equipment and parking must remain within the existing right-of-way.

All construction vehicles are restricted from using Bridgepointe Boulevard and Marina Drive beyond the US 42 right-of-way.

The Contractor is advised that a “no-work zone” is an area where any potentially damaging project activities such as storage yards, waste disposal, borrow pits, staging areas, or other related activities shall not be permitted.

In accordance with the Louisville-Southern Indiana Ohio River Bridges Project’s Section 106-MOA, “no-work zones” have been established within and adjacent to the project area. “No-work zones” include the Allison-Barrickman property, the Drumanard Estate, St. Francis in the Fields Church, and the Strater House property. See Sheet R8 in the plans and the attached location map for further details.

The Contractor shall be permitted to perform testing and monitoring activities in the prescribed “no-work zone” as defined in the contract documents with prior property owner consent.



EXPLORARY TUNNEL AND ACCESS RAMP - NO WORK ZONES



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SPECIAL NOTE FOR BLASTING AND VIBRATION

As stipulated in the Federal Highway Administration's (FHWA) Record of Decision (ROD) and Section 106—Memorandum of Agreement (MOA) for the LSIORBP, the Contractor shall develop and implement construction blasting and vibration plans during construction activities. These plans shall include provisions for pre-construction condition surveys, post-construction condition surveys, construction monitoring, and other measures to minimize harm to historic properties. Where access to privately-owned property is necessary for monitoring or damage repair, the Contractor shall obtain consent prior to entry upon the properties.

Blasting operations shall follow standards of practice as provided in Section 351.330 of the Kentucky Revised Statutes (KRS). The following project requirements supplement these standards of practice:

1. At all times during blasting operations, the Contractor shall monitor ground vibration with the appropriate instrumentation. Four monitoring locations shall be required. The first three locations shall be the Allison-Barrickman House, the Drumanard Estate Main House, and the Strater House. The Contractor shall locate the instrumentation at the closest point of the historic structures to the blasting operations. The fourth monitoring location shall be the closest residential structure to the blasting operation. See Plan Sheet R8 in the plans for more information.
2. Stricter requirements to generally accepted blasting procedures shall be maintained on this project. All blasting operations shall maintain the maximum peak particle velocity of the ground motion no greater than the following at the respective monitoring locations:
 - a. At the Allison-Barrickman House monitoring station—0.2 in/sec.
 - b. At the Drumanard Estate and Strater House monitoring stations—0.2 in/sec.
 - c. At all other residential structure monitoring stations—0.5 in/sec.
 - d. All other structures—2.0in/sec.
3. The Contractor shall perform pre-construction and post-construction condition surveys on all structures within five hundred (500) feet of blasting sites. In addition, pre-construction and post-construction condition surveys shall be performed for the Allison-Barrickman House, for the Drumanard Estate House, for the Strater House, and St. Francis in the Fields Church. Performance of the condition surveys is contingent upon the Contractor acquiring the property owner's consent.
4. The Contractor shall notify the Engineer five (5) days prior to the initial blasting. The Engineer shall notify the Bi-State Management Team (BSMT)

- immediately upon notification to allow coordination of blasting with the project's design team.
5. The Contractor shall notify the Engineer as soon as practical when all post-construction condition surveys have been completed. The Engineer shall notify BSMT when the post-construction condition surveys are complete.
 6. The Contractor is notified that it is the intent that the pre-construction condition surveys are performed before any major excavation activities occur and that the post-construction condition surveys are completed as soon as practicable upon completion of all major construction activities for the project, including the Exploratory Tunnel work. The Contractor shall make these surveys available to the Department at any time upon written request of the Engineer.
 7. The Contractor shall submit a blasting and vibration plan to the Engineer for approval. Blasting operations shall not begin until the Engineer approves the blasting and vibration plan.
 8. The Contractor shall perform one test blast for each bench elevation of the Access Ramp prior to production blasting to establish local ground-borne vibration propagation characteristics.
 9. The Contractor is advised of additional blasting and vibration requirements specifically for the Exploratory Tunnel as set forth by the "Supplemental Specifications for the Exploratory Tunnel."

Blasting and Vibration Monitoring and Recording

The Contractor shall monitor and record ground vibration with appropriate instrumentation, including the test blasts, and shall provide documentation of all blasting and vibration monitoring to the Engineer within one (1) business day of each occurrence. It shall be the Contractor's responsibility to keep and maintain records of instrumentation, maintenance, repair, and calibration of these instruments and provide those records upon written request of the Engineer.

The Contractor is notified that liquidated damages shall apply for any occurrence that exceeds the stipulated vibration limits. For any occurrence that exceeds the stipulated vibration limits by no more than 0.1 in/sec, liquidated damages in the amount of \$500 shall apply. For any occurrence that exceeds the stipulated limits by no more than 0.25 in/sec, liquidated damages in the amount of \$2500 shall apply. In any occurrence that exceeds the stipulated limits by more than 0.25 in/sec, liquidated damages shall apply in the amount of \$5000. Should the Contractor have more than five occurrences in total that exceed the stipulated limits, blasting shall be halted immediately and shall not resume again until receiving BSMT approval. Any occurrence that exceeds the stipulated limits after five incidences, liquidated damages in the amount of \$5000 shall apply regardless of the excess of the measured vibration over the stipulated limits. The Engineer will halt any blasting and/or vibration activity and notify the BSMT after any occurrence in which liquidated damages of \$5000 or greater have been applied. Liquidated damages shall not apply for test blasting.

Road Closure and Blasting Operation Restrictions

Blasting for the Access Ramp construction shall only be allowed during daylight hours after 9:00 a.m. Monday through Saturday. During blasting operations adjacent to KY 841 and US 42, halt all traffic on either side of the impending blast for no more than fifteen (15) minutes to allow for the execution of the shot and for removal of rock fragments and debris. Suitable equipment shall be maintained at the site in running mode for removing any blasting debris and for cleaning the pavement and shoulder areas. After all blasts, the Contractor shall inspect the pavement for debris and damage that may be a hazard to traffic and remove all debris before opening to traffic.

The Contractor is advised of additional blasting and vibration operation restrictions specifically for the Exploratory Tunnel as set forth by the “Exploratory Tunnel Supplemental Specifications.”

When blasting, changing from one traffic pattern to another, and other activities approved by the Engineer, traffic may be halted. Prior approval of the Engineer shall be required for all road closures. It is the intent that all road closures are kept to a minimum time. The Contractor shall schedule operations involving road closures so that all work proceeds in an expeditious manner. Road closures shall be held to a maximum of fifteen (15) minutes. The following liquidated damages shall be assessed if road closures exceed fifteen (15) minutes:

15 minutes to 30 minutes	\$1000
30 minutes to 45 minutes	\$2000
45 minutes to 60 minutes	\$4000

All road closures longer than sixty (60) minutes shall be assessed damages of \$4000 per hour or fraction thereof. Damages for any fraction of an hour shall be charged at the full \$4000 hourly rate. Interruptions to traffic shall not occur more than once in a period of permitted road closures unless normal traffic flow has been restored and the Engineer approves another road closure.

The Contractor shall submit in writing to the Engineer plans for halting traffic. Traffic shall not be halted until the Engineer approves the plans.

Department Vibration Monitoring and Verification

The Contractor is advised that the Engineer may be present at any time while vibration monitoring is being performed by the Contractor. The Contractor shall notify the Engineer of monitoring locations and vibration occurrences should the Engineer elect to verify and/or monitor blasting and/or vibration activities.

Measurement and Payment

The Department will not measure or pay for any items and/or activities performed by the Contractor required in this special note, but will consider them incidental to “Roadway Excavation.”

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SPECIAL NOTE FOR LANE CLOSURES AND MAINTENANCE OF TRAFFIC

Lane closures for KY 841 and US 42 shall not be allowed during the hours from 7:00 a.m. to 9:00 a.m. and from 4:30 p.m. to 6:30 p.m.

The Contractor is further cautioned that the Engineer may, with a minimum of 48 hours written notice, prohibit the closure of any lanes on days that the Engineer determines would be detrimental to traffic for special events or any unusual circumstances not covered in the “Special Note for Fixed Completion Date and Construction Working Hours.”

Temporary crash cushions hit or damaged in any way other than through the Contractor’s negligence, shall be paid for at the contract unit price for Each. This does not apply to crash cushions required on entrance/exit lanes or installed on barrier walls for the Contractor’s convenience. Replacement of these will be incidental to the contract.

The Contractor shall designate an employee to be the Traffic Control Coordinator. The Coordinator shall be responsible for the inspection of the project maintenance of traffic for the duration of the project. The Coordinator shall report all incidents throughout the work zone to the Engineer. The Contractor shall furnish the name and telephone number where the Traffic Control Coordinator can be contacted at any time.

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SPECIAL NOTE FOR EXPLORATORY TUNNEL

1.1 SUMMARY

- A. This Section includes General Notes for Exploratory Tunnel Work.
- B. These General Notes supplement the Standard General Provisions of the Construction Contract, the Department's 2004 *Standard Specifications for Road and Bridge Construction*, and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

1.2 DEFINITIONS AND TERMS

- A. These requirements are in addition to Division 100- General Conditions, Section 101 – Definitions and Terms, Subsection 101.02 – “Abbreviations” and Subsection 101.03 – “Definitions”.
- B. Additional abbreviations
 - 1. MHSA: Mines Health and Safety Administration.
 - 2. GDR: Geotechnical Data Report
 - 3. GBR: Geotechnical Baseline Report
- C. Additional definitions
 - 1. Geotechnical Data Report: The GDR provides a detailed description of the field and laboratory methods and procedures used in the design. It describes the factual conditions at those particular locations at a particular point in time.
 - 2. Geotechnical Baseline Report: The GBR provides geotechnical interpretations of the available data from the GDR. The primary purpose of the GBR is to establish a contractual statement of the geotechnical conditions anticipated to be encountered during subsurface construction.
 - 3. Baseline: Contractual statement as provided in the GBR document. The baseline provides:
 - a. Geotechnical and construction conditions that form the basis of the design of the tunnel.
 - b. Clear indications in the contract for resolution of disputes concerning subsurface conditions.

1.3 INTERPRETATIONS OF QUANTITIES IN BID SCHEDULE

- A. These requirements are in addition to Division 100- General Conditions, Section 102 – Bidding Requirements and Conditions, Subsection 102.05 – “Interpretations of Quantities in Bid Schedule”.
- B. Contractual understanding of “Geotechnical Data Report” (GDR) and “Geotechnical Baseline Report” (GBR).
 - 1. The Contractor acknowledges that any geotechnical, soils or subsurface reports, including core sample reports, referenced in the “Geotechnical Data Report” (GDR) and Contract Documents are intended to describe the factual conditions at those particular locations at a particular point in time, and are not guaranteed to represent the actual conditions the Contractor will encounter during the course of the Project.
 - a. The GDR provides a detailed description of the field and laboratory methods and procedures used in the design.
 - b. The GDR and Contract Documents are used to determine a baseline for the Exploratory Tunnel project Work.
 - 2. The Contractor acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site and from the information available to the Contractor.
 - 3. The GBR provides geotechnical interpretations of the available data from the GDR.
- C. By bidding for the Project and by executing the Contract, the Contractor certifies that it has carefully reviewed, has had clarified and understands all of the Contract Documents; has inspected the job site as needed to evaluate and assess all pertinent existing conditions applicable to the Project, and is satisfied as to its ability and intention to conduct and complete the Project Work required in the Contract Documents on the terms and conditions stated in the Contract. In particular, the Contractor certifies that it has reviewed the requirements for the formal and detail of records, to be maintained at all times during the performance of Project, and that it has instituted or will implement the preparation and maintenance of all such records. Any failure of the Contractor to take actions described and acknowledged in this Section will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the Project, or for proceeding to successfully perform the Project Work without additional expense to the Department.

1.4 COORDINATION OF CONTRACT DOCUMENTS

- A. For work directly associated with the construction of the exploratory tunnel these requirements are partial replacement to Division 100- General

Conditions, Section 105 – Control of Work, Subsection 105.05 –
“Coordination of Contract Documents”.

- B. A copy of the “Geotechnical Data Report Exploratory Tunnel” (GDR) is available. Request for a copy of the GDR should be made to:

Department of Highways
Transportation Cabinet Office Building
Division of Construction Procurement
200 Mero Street, 3rd Floor
Frankfort, Kentucky 40622
Telephone: (502) 564-3500
Fax: (502) 564-8961 or (502) 564-7299

- C. Replace “Documents” list with the following:
1. Special Notes
 2. Special Provisions
 3. Plans (Contract Drawings)
 4. Exploratory Tunnel Supplemental Specifications
 5. GBR
 6. Standard Specifications

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**SPECIAL NOTE FOR CONSTRUCTION PHASING OF EXPLORATORY
TUNNEL**

The Contractor is notified that as work progresses to excavate the Exploratory Tunnel, the Department will be conducting geophysical investigation work inside and in the direct vicinity of the tunnel. The Contractor and the Department shall coordinate and communicate their efforts to minimize conflicts of schedule and production. The Contractor shall assist, as required by the Engineer, in facilitating this work.

The Exploratory Tunnel and exploration bays shall be constructed in sequence to facilitate the geotechnical and geophysical work for the ultimate tunnel design as part of the Louisville-Southern Indiana Ohio River Bridges Project.

The Contractor shall not complete construction of the full length of the Exploratory Tunnel mainline before beginning excavation of the individual exploration bays.

Excavation of the Exploratory Tunnel shall not progress more than one hundred (100) feet beyond the end station of an exploration bay until construction of the adjacent exploration bay has been completed.

The Contractor shall make no claim or request additional compensation for delay or impact to schedule for this work.

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SPECIAL NOTE FOR INCIDENT RESPONSE PROCEDURES

The Contractor shall coordinate with the local emergency authorities before the commencement of work and at regular intervals during the contract period. The Contractor shall provide to the local emergency authorities names of the Contractor's on-site Project Manager and Safety Officer, their contact information, and how they may be reached at any time.

The Contractor shall be responsible for the preparation of an Incident Response Plan to ensure preparedness for unplanned events that have the potential for endangering or harming personnel, or having a serious impact on the project or surrounding property and environment.

The Incident Response Plan shall identify the Contractor's personnel responsible for taking the actions described in the Plan at all times. The Contractor shall ensure that the responsible personnel are competent, fully trained for their role, and formally notified of their responsibilities and the period during which they are responsible.

The Incident Response Plan shall include contact information that the Contractor may use for sources of response specialists and those members of the Contractor's personnel that would be involved in an emergency response.

The Incident Response Plan shall identify the external agencies that may be involved in the response to an event. These agencies may include:

- Harrods Creek Fire Department
- Louisville Fire Department
- Louisville Metro EMS
- Louisville Metro Police Department
- City of Prospect Police Department
- Louisville and Jefferson Metro Management Agency / MetroSafe
- Department of Mines and Minerals (mine rescue support)
- Louisville Gas and Electric Company
- Louisville Water Company

The Incident Response Plan shall also include contact information for the appropriate Department personnel in order to keep the Department informed of such events at all times.

Information contained in the Incident Response Plan should be coordinated with information required by Section 01 35 00—Safety Procedures for Tunnel Construction as contained in the Exploratory Tunnel Supplemental Specifications.

Copies of the approved Incident Response Plan shall be provided to the Engineer and the Contractor shall be required to keep a copy on the project site at all times.

No separate payment shall be included for work associated with items contained in this special note. All costs including any and all incidentals associated with this work shall be considered incidental to the bid item “Tunnel Safety Monitoring and Training” as specified in Section 01 35 00—Safety Procedures for Tunnel Construction as contained in the Exploratory Tunnel Supplemental Specifications.

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SPECIAL NOTE FOR TEMPORARY SITE FACILITIES AND CONTROLS

This Section covers the provision, installation, maintenance, and removal of temporary facilities for the use of the Contractor during construction of the Exploratory Tunnel including but not limited to the following:

1.1 TEMPORARY ELECTRICITY

- A. Louisville Gas and Electric (LG&E) will provide a 500 kVA, 480/277 volt, three phase, four wire outdoor pad mounted transformer at the location as indicated on the Contract Drawings.
- B. The following is the contact information for the electrical utility:
 - Utility Name: Louisville Gas and Electric (LG&E)
 - Contact Name: Jim Holderman
 - Contact Phone: 502-333-1917
- C. The Contractor shall coordinate with the utility, file any applications, pay any permitting or inspection fees required for the electrical installation and pay for all energy costs.
- D. LG&E shall furnish and install a grounded transformer pad sized for 500 kVA transformer in accordance with LG&E standards and drawings. Contractor to coordinate and liaison with LG&E on scheduling and installation of the equipment.
- E. LG&E shall furnish and install approximately 275 linear feet of aerial 3 phase stranded primary wire, one (1) 50-foot wood pole, 50 linear feet of 6-inch PVC duct on the pole to grade, 10 linear feet of 6-inch buried Schedule 80 conduit, one (1) 500kVA 3 phase transformer pad mount, one (1) precast concrete transformer pad, and associated appurtenances that shall include, as a minimum per requirements of subparagraph 1.1.F: Current transformers (CT's), terminal hook up of secondary cables to the transformer and one (1) meter in the CT cabinet
- F. The Contractor shall furnish and install the secondary conduit from the transformer to a Current Transformer (CT) cabinet furnished and installed by the Contractor. CT's shall be furnished by LG&E and installed in cabinet by the Contractor. LG&E shall terminate the secondary cables on the transformer. Contractor shall furnish and install a meter socket. Meter shall be furnished by LG&E and installed by the Contractor in accordance with LG&E requirements.

- G. LG&E shall install grounding for transformer in accordance with LG&E standards and drawing requirements.
 - H. The Contractor shall furnish and install a Service Entrance Rated 600 amp (minimum), NEMA 3R Main Distribution Panel or Fused disconnect switch to be installed near the transformer pad
 - I. All Contractor-supplied electrical equipment shall be supplied with an AIC/short circuit rating large enough to protect it against the available short circuit current from the utility. Contractor to coordinate with utility company.
 - J. The Contractor shall make suitable arrangements for any additional power required over and above that supplied by the Utilities 500 kVA transformer.
 - K. The Contractor shall provide sufficient emergency back up power supply to maintain those services necessary for life safety in the tunnel which will include as a minimum pumps, ventilation, and gas monitoring equipment.
 - L. The Contractor shall provide all power distribution panels, power outlets, step-down power centers, feeders, branch circuit wiring, etc. as required for construction operations including tunneling equipment, ventilation, compressed air, sump pumps, site lighting, tunnel lighting, temporary office trailers, etc. Refer to Section 01 51 00 - Tunnel Ventilation and Utilities of the Exploratory Tunnel Supplemental Specifications for additional details.
 - M. All electrical equipment shall be installed in accordance with NFPA 70, NFPA 70E, NFPA 241, and OSHA 1926.800.
 - N. The Contractor shall be responsible for all material and labor required to ground the electrical installation in accordance with NFPA 70 – National Electrical Code.
 - O. Prior to energizing, check circuitry for electrical continuity and for short-circuits.
- 1.2 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES
- A. Temporary Lighting shall be in accordance with Special Note for Temporary Lighting
- 1.3 TEMPORARY VENTILATION
- A. Temporary tunnel ventilation shall be in accordance with Section 01 51 00 - Tunnel Ventilation and Utilities of the Exploratory Tunnel Supplemental Specifications.

1.4 TELEPHONE SERVICE

- A. Provide, maintain, and pay for telephone service to Engineer's field office in accordance with Special Note for Engineer's Field Office.
- B. The following is the contact information for the telephone utility:

Utility Name: Bellsouth Telecommunication, Inc.
Contact Name: Derrick Nixon
Contact Phone: 502-454-0136

1.5 TEMPORARY WATER SERVICE AND FIRE SERVICE

- A. Provide and pay for potable water as required for the field construction office.
- B. Provide and pay for water service required from utility source (LWC) as needed for fire protection and construction operation. Contractor shall coordinate, file an application and pay any fees for all permitting required for the water utility installation.
- C. The following is the contact information for the water utility:

Utility Name: Louisville Water Company
Contact Name: Keith Coombs
Contact Phone: 502-569-3600 Ext. 3682

1.6 PARKING

- A. Provide temporary parking areas to accommodate construction personnel.
- B. Locate as indicated on Drawings or as agreed by Engineer.
- C. Tracked construction equipment not allowed on paved areas.
- D. Do not allow heavy vehicles or construction equipment in parking areas.
- E. Maintenance:
 - 1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
 - 2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.
- F. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.7 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Collect and remove waste materials, debris, and rubbish from site as required and dispose off-site.

1.8 SECURITY

- A. Security Program:
 - 1. Protect Work from theft, vandalism, and unauthorized entry.
 - 2. Initiate program at project mobilization.
 - 3. Maintain security program throughout construction period until project is formally accepted.
- B. Entry Control:
 - 1. Restrict entrance of persons and vehicles into Project site.
 - 2. Allow entrance only to authorized personnel.

1.9 MEASUREMENT AND PAYMENT

- A. Measurement
 - 1. The Department will measure the Work as detailed in this Section of the Specification, including: design; labor; installation; installation tools and equipment; manufacturers' products; and component parts and devices, as a lump sum, acceptably performed.
- B. Payment
 - 1. The Department will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Payment Item</u>	<u>Pay Unit</u>
22422NN	Temporary Site Facilities and Controls	Lump Sum

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SPECIAL NOTE FOR MAINTENANCE AND PROTECTION OF PROJECT SITE

Upon completion of the Exploratory Tunnel and geotechnical investigations, the Department anticipates that approximately eight (8) months will be required to complete the design work for the ultimate tunnels as part of the Louisville-Southern Indiana Ohio River Bridges Project. As part of the eight-month interim design period, the Department will require the Contractor to maintain and secure the project site.

This Special Note provides for the maintenance and protection of electrical and mechanical systems installed as temporary construction utilities within the Project Site, Exploratory Tunnel, and Exploration Bays including support equipment at the Portal, and in general, the entire project site.

The expected duration of the maintenance and protection program shall be eight (8) months. The Engineer will coordinate with the Contractor to establish the termination date of this maintenance and protection period and formally accept the project by the Department. The Department reserves the right to extend this maintenance and protection period for the duration of no more than an additional twelve (12) months. Any extension of the maintenance and protection period beyond the original eight (8) month period will be executed through a supplemental agreement as provided for in Section 109 of the Department's 2004 *Standard Specifications for Road and Bridge Construction*.

The Engineer shall determine the date on which the excavation and structural support of the tunnel and geotechnical investigations are complete and inform the Contractor in writing of the date of commencement of the maintenance period.

1.1 GENERAL

- A. The Contractor shall maintain, test, and exercise on a regular basis, service and repair as required, all installed temporary utilities, which may include but are not limited to, temporary electrical, mechanical, and ventilation systems.

1.2 TEMPORARY POWER

- A. Provide and maintain all equipment and component devices as outlined in Special Note for Temporary Site Facilities and Controls and 01 51 00 - Tunnel Ventilation and Utilities.

1.3 TUNNEL

- A. Undertake weekly inspection of tunnel initial support systems and any exposed ground to determine need for remedial works to installed support or for installation of supplemental supports as required by Section 31 72 13 – Rock Reinforcement and Support. Submit records to Engineer for agreement in case of supplemental support.
- B. Provide ventilation of the tunnel with the tunnel ventilation fan and weekly equipment exercising, maintenance, protection, and cleaning of all related equipment, products, and systems.
- C. Pumping systems shall be operated on a regular basis to minimize the build-up of water. The Contractor shall undertake weekly testing to ensure back-up and redundant systems remain functional.
- D. Exercise other mechanical, electrical, and water supply/fire systems once weekly for one hour durations, or as agreed with the Engineer, and provide documentation to the Engineer.
- E. Maintain equipment products and systems.
 - 1. At the manufacturers' recommended regular maintenance intervals, clean or replace filters, fluids, elements, lamps, and other necessary operating equipment as required by the manufacturers' mechanical and electrical operating system manuals.
 - 2. Lubricate, clean, and perform other recommended maintenance of the electrical and mechanical systems.
- F. Renew equipment, products and systems.
 - 1. Prior to the end of the maintenance and protection period, install new filters, fluids, elements, lamps, and other necessary parts in all mechanical and electrical operating systems.
 - 2. Lubricate and clean parts of the electrical and mechanical equipment.
- G. Exercise water systems.
 - 1. Provide and maintain temporary water service for the monthly exercising.
 - 2. Flush lines: Go to end of line and flush for five-minutes, and then briefly open each intermediate valve to exercise them.
- H. Inspect fire extinguishers once every six months.
 - 1. Inspect and maintain fire extinguishers in proper working condition.
- I. Maintain, service, and test the temporary communication systems.

- J. Maintain, service, and test the gas detection systems and undertake calibration of instruments at intervals as recommended by the manufacturer.

1.4 SECURITY

- A. Provide and maintain a lockable gate at the Exploratory Tunnel portal to secure the tunnel from unauthorized entry.
- B. Provide locks and keep secure the Double Vehicular Chain Link Gates at US 42/Access Ramp and KY 841/Access Ramp.
- C. Protect project site from theft, vandalism, and unauthorized entry.
- D. Restrict entrance of persons and vehicles into project site.
- E. Allow entrance for authorized personnel as approved by the Engineer.
- F. Maintain a log of Contractor's personnel and authorized persons who enter the project site. Make available to the Engineer on request.

1.5 SCHEDULED SITE VISITS

- A. The Engineer will notify the Contractor at least forty-eight (48) hours in advance of any site visits that would require entry into the Exploratory Tunnel. The Engineer will provide the Contractor information to facilitate preparation of the project site.
- B. Prior to any scheduled site visits arranged by the Department, test and service ventilation fans and all other above necessary equipment and systems to assure safe access at the planned arrival time, as specified in Section 01 51 00—Tunnel Ventilation and Utilities as provided in the Exploratory Tunnel Supplemental Specifications.
- C. Provide all Department or other authorized personnel with proper safety and protection equipment and induction training required for entry into the Exploratory Tunnel and specified in Section 01 35 00—Safety Procedures for Tunnel Construction as provided in the Exploratory Tunnel Supplemental Specifications.
- D. Remain on site throughout the duration of the Department's site visits, maintain the site, and secure the site from any unauthorized persons.
- E. For routine Department visits to the project site not requiring entry into the Exploratory Tunnel, the Contractor shall provide access to the project site upon notice from the Engineer.

1.6 COMPLETION DATE OF MAINTENANCE AND PROTECTION PERIOD

- A. The Engineer shall notify the Contractor, in writing, at least 30 days prior to the scheduled completion date of the maintenance and protection period.
- B. Before the date of transfer of the site to the Department, the Contractor shall prepare details of installations in accordance with Section 01 70 00 - Execution and Close Out Requirements.

1.7 SCHEDULE OF BID ITEMS

- A. Measurement
 - 1. The Department will measure the maintenance and protection of the Project Site and Exploratory Tunnel along with any and all incidentals to perform the work as a lump sum.
 - 2. The Department will allow payment for Contractor's monthly utility bills during the maintenance and protection period of the project. The Department will consider the cost of monthly utility bills during the construction portion of the project as a responsibility of the Contractor.
 - 3. The Department will measure the item for scheduled site visits to the project by Department officials or authorized personnel of the Department who require access to the Exploratory Tunnel. The Department will not measure the Contractor's site visits to the project site to perform the Work described in this Special Note. The Department will not measure routine visits from Department personnel that do not require access to the Exploratory Tunnel, but will consider this incidental to the bid item "Visit to Exploratory Tunnel."
- B. Payment
 - 1. The Department will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Payment Item</u>	<u>Pay Unit</u>
22423NN	Monthly Maintenance and Protection	Each
22438NN	Utility Bills	Dollar
22424NN	Visit to Exploratory Tunnel	Each

- C. The Contract Item
 - 1. Additional monies may be set up with a change order if the existing contract amount is insufficient to pay for the items necessary for maintenance and protection Payment Items should the contract amount prove insufficient for either the initial maintenance period or for an extended maintenance period required.

2. The Unit Price for utility bills shall be \$1.00. The quantity paid will be the actual adjustment after completion of the maintenance and protection period.

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SPECIAL NOTE FOR SUBMITTAL PROCEDURES

In addition to work described for submission of working drawings in Section 105—Control of Work in the Department's 2004 *Standard Specifications for Road and Bridge Construction*, the Contractor shall be required to submit to the Engineer the following information in form and format:

- D. Submittal procedures
- E. Construction progress schedules
- F. Shop drawings
- G. Samples
- H. Test reports
- I. Certificates
- J. Manufacturer's instructions
- K. Manufacturer's field reports

SUBMITTAL PROCEDURES

- A. Transmit each submittal with Engineer accepted form.
- B. Provide ten (10) hard copies and two (2) electronic copies (CD's - ROM Format) for all submittals.
 - 1. Text documents
 - a. Hard copies - 8 ½ x 11 and/or 11 x 17 paper
 - b. Electronic copy - Microsoft Word 2000
 - 2. Drawings
 - a. Hard copies – 22 x 36 paper
 - b. Electronic copy – Bentley Microstation Version 8
 - 3. Schedules and Programs
 - a. Hard copies - 8 ½ x 11 and/or 11 x 17 paper
 - b. Electronic copy – Primavera P3
 - 4. Certificates, test documents & others not available in electronic format
 - a. Hard copies - 8 ½ x 11 paper
 - b. Electronic copy – scanned pdf file
 - 5. Calculations

- a. Hard copies - 8 ½ x 11 paper
 - b. Electronic copy – scanned pdf file
 6. Signed documents
 - a. Hard copies - 8 ½ x 11 paper
 - b. Electronic copy – scanned pdf file
 7. Spreadsheets
 - a. Hard copies - 8 ½ x 11 and/or 11 x 17 paper
 - b. Electronic copy – Microsoft Excel 2000
 8. Test Reports
 - a. Hard copies - 8 ½ x 11 paper
 - b. Electronic copy – scanned pdf file
- C. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- D. Identify Project, Contractor, Subcontractor, and Supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- F. For each submittal for review, allow 28 days excluding delivery time to and from Contractor.
- G. Identify variations from Contract Documents and material or equipment limitations that may be detrimental to successful performance of completed Work.
- H. Allow space on submittals for Contractor and Engineer review stamps.
- I. When revised for resubmission, identify changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

CONSTRUCTION PROGRESS SCHEDULES

- A. Submit schedules as identified in Special Provision 82—Special Provision for General Progress Schedule.

SHOP DRAWINGS

- A. Shop Drawings: Submit to Engineer for review to check for conformance with Contract Documents.

- B. When required by individual specification sections, provide shop drawings signed and sealed by Professional Engineer responsible for designing components shown on shop drawings.
 - 1. Include signed and sealed calculations to support design.
 - 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 - 3. Make revisions and provide additional information when required by authorities having jurisdiction.

SAMPLES

- A. Samples: Submit to Engineer for review for limited purpose of checking for conformance with Contract Documents.
- B. Include identification on each sample, with full Project information.
- C. Submit number of samples specified in individual specification sections.
- D. Samples will not be used for testing purposes unless specifically stated in specification section.

TEST REPORTS

- A. Submit to the Engineer as detailed in the Contract Documents.
- B. Submit test reports for information for limited purpose of assessing conformance with Contract Documents.

CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in accordance with the Contract Documents.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, and installation and finishing, to Engineer for delivery to the Department as indicated in the Contract Documents.

- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Engineer's benefit as contract administrator or for Department.
- B. Submit report within 2 days of observation to Engineer for information.
- C. Submit for information for limited purpose of assessing conformance with Contract Documents.

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SPECIAL NOTES FOR ESCROW BID DOCUMENTS

A. Summary

1. Within three (3) business days after opening of the bids, the three low bidders shall submit all original information and calculations used to determine their bid prices and schedule for this project. This material is hereinafter referred to as "Escrow Bid Documentation." A copy of this Bid Documentation hereinafter referred to as "Escrow Bid Documents," will be held in escrow for the duration of the Contract.
2. The Escrow Bid Documents are, and shall always remain, the property of the Contractor, subject to use by the Department, as provided herein.
3. The apparent low bidder agrees, as a condition of award of the Contract, that the Escrow Bid Documents constitute all the information used in the preparation of his bid, and that no other bid preparation information shall be considered in resolving disputes or claims. The apparent low bidder also agrees that nothing in the Escrow Bid Documents shall change or modify the terms or conditions of the Contracts.
4. Escrow Bid Documents submitted by unsuccessful bidders will be returned unopened, unless opened as provided for above, following the Award of the Contract.

B. Purpose

1. Escrow Bid Documents may be used to assist in the negotiation of price adjustments and the settlement of disputes, claims, and change orders. They will not be used for post-bid, pre-award qualification of the Contractor or for evaluation of the Contractor's anticipated methods of construction.
2. The Department stipulates and expressly acknowledges that the Escrow Bid Documents, as defined herein, constitute trade secrets. This acknowledgment is based on the Department's express understanding that the information contained in the Escrow Bid Documents is not known outside bidder's business, is known only to a limited extent and only by a limited number of employees of the bidder, is safeguarded while in bidder's possession, is extremely valuable to bidder and could be extremely valuable to bidder's competitors by virtue of its reflecting bidder's techniques of construction. The Department further acknowledges that bidder expended substantial sums of money in developing the information

included in the Escrow Bid Documents and further acknowledges that it would be difficult for a competitor to replicate the information contained herein. The Department further acknowledges that Escrow Bid Documents and the information contained therein are being provided to the Department only because it is an express prerequisite to the award of the Contract. The Department further acknowledges that the Escrow Bid Documents include a compilation of information used in bidder's business, intended to give bidder an opportunity to obtain an advantage over competitors who do not know of or use the contents of the Escrow Bid Documents. The Department further agrees to safeguard the Escrow Bid Documents against disclosure to the fullest extent permitted by law.

C. Format

1. Bidders are encouraged to submit Escrow Bid Documents in their usual cost-estimating format. It is not the intention of this specification to cause the bidder extra work during the preparation of his bid, but to insure that the Bid Documents will be adequate to enable complete understanding and proper interpretation for the intended use.
2. In accordance with the above paragraph, it is required that the Escrow Bid Documents clearly itemize the estimated costs for each bid item contained in the bid schedule.
3. Bid items should be broken down into sub-items as required to allow a detailed cost estimate. Estimated costs should be broken down into the bidder's usual estimate categories such as direct labor, repair labor, equipment parts and supplies, expendable materials, permanent materials, and subcontract cost as appropriate. Unit prices, without a detailed estimate, are acceptable for minor items. Plant and equipment and indirect costs should be detailed in the bidder's usual format. Plant and equipment charges, indirect costs, and markup allocations shall be made to each bid item as appropriate. All costs shall be identified.
4. The Escrow Bid Documents should include all quantity takeoffs, calculations of rates of production and progress, copies of quotes from subcontractors and suppliers, and memoranda, narratives, add/deduct sheets, and all other information used by the bidder to arrive at the prices contained in this bid.
5. The Project Contract Documents provided by the Department should be included in the Escrow Bid Documents.
6. All costs shall be identified. For bid items amounting to less than \$10,000 in total, estimated unit costs are acceptable without a detailed cost estimate, provided that labor, equipment, materials, and subcontractors, as applicable, are included and that indirect costs, contingencies and markup, as applicable, are allocated.

D. Submittals

1. The Escrow Bid Documents shall be submitted in a sealed container and shall be clearly marked with the bidder's name, date of submittal, project name and the words "Escrow Bid Documents."
2. The Escrow Bid Documents shall be accompanied by the following affidavit:

AFFIDAVIT

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THE BID DOCUMENTATION CONTAINED HEREIN CONSTITUTES ALL THE INFORMATION USED IN PREPARATION OF THE BID AND THAT I HAVE PERSONALLY EXAMINED THESE CONTENTS AND HAVE FOUND THAT THIS BID DOCUMENTATION IS CORRECT AND COMPLETE.

By:

TITLE:

FIRM:

3. The affidavit shall be signed by an individual authorized by the bidder to execute the bidding, stating that the material in the Escrow Bid Documents constitutes all the information used in preparation of the bid and that he has personally examined the contents of the Escrow Bid Documents container and has found that the documents in the container are correct and complete.
4. Prior to the Award of the Contract, the Escrow Bid Documents of the apparent low bidder will be examined, organized and inventoried by up to five of the Department's designated review representatives and members of the Contractor's staff who are knowledgeable in how the Escrow Bid Documents were prepared.
5. This examination is to ensure that the Escrow Bid Documents are legible and complete, and will not include review, and does not constitute approval of proposed construction methods, estimating assumptions, or interpretations of the Contract Documents. Examination does not alter any conditions or terms of the Contract. Incomplete or missing data shall be supplied within 1 business day after its request.

6. Failure to submit Escrow Bid Documents as specified herein or to comply with the schedule for submission of this documentation will be sufficient cause for the Department to reject the bid.
7. Escrow Bid Documents submitted by unsuccessful bidders will be returned unopened, unless opened as provided for above, following the Award of the Contract.
8. If the bidder's proposal is based on subcontracting any part of the Work, each subcontractor whose total subcontract price exceeds ten percent of the total contract price proposed by the bidder, shall provide a separate Escrow Bid Document to be included with those of the bidder. These documents will be opened and examined as described above for the apparent low bidder.
9. This will include a signed affidavit from the Subcontractor, acceptable to the Cabinet, that the documentation is complete and will be the only basis for resolution of disputes on those items.
10. If the Contractor wishes to subcontract any portion of the Work after Award, the Department retains the right to require the Contractor to submit Escrow Bid Documents from the subcontractor before the subcontractor will be allowed to work on project.

E. Storage

1. Escrow Bid Documents shall be placed in escrow, during the life of the Contract, in an escrow institution mutually agreed to by both the Department and Contractor. The Department will pay the cost of storage.

F. Examination

1. The Escrow Bid Documents may be examined at any time deemed necessary by both the Department and the Contractor, to determine the Contractor's bid concept and assumptions, and to assist in the negotiation of price adjustments or the settlement of disputes, claims or change orders.
2. Examination of the Escrow Bid Documents is subject to the following conditions:
 - a. The Escrow Bid Documents are proprietary and confidential and shall be treated as such by the Department's designated review representatives. These documents, and all the contents thereof, are not part of the public record and shall not be made available to any person or persons not herein designated without the specific written consent of the Contractor.
 - b. The Department and the Contractor shall each designate three local representatives who are authorized to examine the Escrow Bid Documents. On request of both the Department and the Contractor, the designated representative may examine the Escrow Bid Documents.

No other person shall have access to the Escrow Bid Documents.

- c. Each party shall designate a local representative to receive requests to examine the Escrow Bid Documents.
- d. Prior to examining the Escrow Bid Documents, 48 hours written notice shall be given to the other party, so that the other party can witness the examination.
- e. The Department's authorized representative may have access to the documents only in the presence of an authorized representative of the Contractor.
- f. The Contractor, or his authorized representative, may have access to the documents only in the presence of an authorized representative of the Department.
- g. An authorized representative of both the Department and the Contractor will be present during examination of the Escrow Bid Documents.

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NH-2653 (018)
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Exploratory Tunnel and Access Ramp

SPECIAL NOTE FOR ENGINEER'S FIELD OFFICE

1.1 SUMMARY

- A. This work shall consist of furnishing and maintaining, in good condition, suitable offices for the exclusive use of the Engineer, as a field office, all in accordance with the specifications included in this special note.

1.2 LOCATION AND TIME OF INSTALLATION

- A. The field office (or trailer of equivalent capacity) shall be set up at an approved location on or in the immediate vicinity of the Project, on property owned by the Department and designated on plans as Contractor's Worksite.
- B. The field office shall be set up, equipped, and made ready for use at least seven (7) days prior to the Contractor beginning work on the Project

1.3 OFFICE BUILDING

- A. The field office shall have a minimum floor space of 600 sq. ft. and shall contain two office rooms, each with a minimum plan dimension of 10 ft. by 10 ft. and one meeting/conference room.
- B. The office shall be entirely enclosed, waterproofed, and sealed inside with wall board which will provide efficient insulation against heat and cold weather. The building shall have a pitched roof and two ventilating louvers, one in each gable, in order to provide for circulation of air between the roof and the ceiling. The floor shall be double thickness, with building paper between layers, and the ceiling height shall be not less than seven feet. All doors, both interior and exterior, shall be equipped with locks. Windows, to furnish natural light (a minimum of 80 sq. ft.) shall be constructed to open and close and shall be provided with blinds and latches. Screens shall be provided for all windows and exterior doors, and the building shall be generally "fly-tight". The screen doors shall be equipped with springs and latches. There shall be a minimum of two doors in opposite ends of the building with porches or landings (minimum 4ft by 8 ft level with the door sill elevation and steps as necessary).
- C. The office shall be provided with an approved type of heating and cooling equipment which will maintain a comfortable seasonable temperature (not less than 68 degrees F in cold weather and not more than 76 degrees F in

hot weather) and lighting service. A minimum of four duplex electrical outlets shall be provided in each room. The building shall be provided with neat, sanitary, enclosed toilet accommodations for the exclusive use of the Engineer, and such facilities shall meet the requirements of the State Department of Health or other local governmental authorities for sanitary sewer requirements.

- D. The electrical, water, and telephone services are to be installed and made operational in accordance with “Special Note for Temporary Site Facilities and Controls” as found elsewhere in the contract documents. The billing accounts will be transferred to the Department and monthly billing for each will then be paid by the Department.
- E. The office shall be attractively painted on the outside and shall be provided with sign at least 4 ft. by 2 ft., with the following wording:

FIELD OFFICE

KENTUCKY DEPARTMENT OF HIGHWAYS

- F. The letters shall not be less than three inches high and shall be black on white background. The sign shall have a border of at least 1 & ½ inch width.
- G. The office shall be provided with an outside security door that has a dead bolt type tumbler lock.

1.4 PARKING LOT

- A. The Contractor shall provide a parking lot suitable for parking 6 pickup trucks.
- B. The parking lot shall be well-graded and constructed of stabilized surface.
- C. The parking lot shall be well-lighted at and easily accessible from the Access Ramp. See “Special Note for Temporary Lighting” for additional detail.
- D. The parking lot shall be located adjacent to the field office.

1.5 INSURANCE

- A. By the time the Field Office is made available to the Engineer, the Contractor shall have furnished the Engineer with evidence that insurance has been obtained and is in effect which will protect the Department to the extent of \$50,000, (non-deductible), against any loss of its property in the field office and equipment as a result of fire or theft.

- B. This insurance policy must be kept in force until the project is formally accepted, but in no case less than twenty-four (24) months. The evidence of renewal of the policy as necessary must be forwarded to the Engineer.

1.6 MAINTENANCE

- A. The Field Office shall be maintained in good condition and appearance by the Contractor for the duration of the project. No compensation will be allowed for loss by fire or by vandalism caused by non-Departmental or non-Engineering personnel, or for loss due to normal wear and tear.

1.7 OWNERSHIP

- A. Upon formal acceptance of the project, the Field Office and all required equipment will become the property of the Department. Maintenance requirements will also become the responsibility of the Department upon formal acceptance.

1.8 EQUIPMENT

- A. The following equipment shall be furnished by the Contractor for use in the Field Office:
 1. Two standard office-type desks having at least two drawers on each side, having minimum top dimension of 30 inches by 60 inches. There shall be a quartz-halogen or fluorescent desk light for each desk or table plus overhead lights in each room.
 2. Three standard, four-drawer, letter size filing cabinets, equipped with locks.
 3. One plan rack.
 4. One utility table 30 inch high and having top dimensions not less than 30 inches by 72 inches.
 5. One sanitary-type water cooler supplied with bottled or running water that shall be kept cooled electrically.
 6. One closet extending the full height from floor to ceiling, measuring not less than 24 inches by 30 inches in plan, having at least two shelves, and equipped with a lockable door knob.
 7. A minimum of 14 comfortable chairs as approved by the Engineer.
 8. A standard conference/meeting table sized to accommodate no less than ten persons.
 9. Telephone service, limited to the best available local service, shall be furnished.
 10. Two telephone lines, two telephones, and one answering machine shall be provided.
 11. The Contractor shall also furnish a large first aid kit, fire extinguishers (one at each door), one bookcase (4ft wide, 5 ft tall, 12 inches deep with at least 4 shelves), and two metal trash cans in each room. The Contractor shall also furnish two large weather-

- tight trash cans for the outside and one bulletin board.
12. If any of the above listed items of equipment are included as “built-in” features of the field office, then they may be omitted.

1.9 MEASUREMENT AND PAYMENT

A. Measurement

1. The Department will measure the Work as detailed in this Special Note, including: design; labor; installation; installation tools and equipment; manufacturers products; and component parts and devices as a lump sum, acceptably performed.

B. Payment

1. The Department will make payment for the completed and accepted quantity under the following:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
22420NN	Furnish and Install Field Office	Lump Sum

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SPECIAL NOTE FOR WASTE SITES

The Contractor is notified that excess material generated from this project only may be placed within the right-of-way limits at the Old Henry Road/I-265 Interchange or at the Exit 14 I-71 Interchange. The Department has obtained the necessary clearances and permits for these two locations. The Contractor is advised that exact limits are identified for waste disposal in these locations, and the Contractor shall coordinate with the Engineer to stay within the limits of the approved waste sites. The District 5 Branch Manager for Operations must review and approve the placement of excess material at any location within existing rights-of-way. The Contractor is advised that any additional items such as necessary traffic control items, additional drainage improvements, or any incidental work or materials required at the location in the placement of excess material shall be considered incidental to the bid item "Roadway Excavation."

The Contractor is advised that additional waste sites may be necessary. Should additional waste sites become necessary, it is the responsibility of the Contractor to locate, acquire, and obtain any and all necessary permits, clearances, and approvals for the use of those locations. Permits may include, but are not limited to, U.S. Army Corps of Engineers, Division of Water, and Kentucky Department of Fish and Wildlife. Necessary clearances may include, but are not limited to, Native American Consultation, archaeology, and environmental clearances.

The Contractor shall be responsible for determining if additional waste sites are required to perform the Work and for any costs or fees associated with obtaining the approval for the use of such sites.

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SPECIAL NOTE FOR FENCING

The existing wooden fence, right of KY 841 Station 91+85.33 to right Ramp A Station 36+50 separating KY 841 and the Bridgepointe subdivision shall not to be disturbed.

The proposed wooden visual barrier fence adjacent to the Bridgepointe subdivision and chain link fencing shall be fully constructed before beginning other construction activities.

Repairs to and maintenance of the chain link and wooden visual barrier fencing and gates are the responsibility of the Contractor and are incidental to the respective bid items “Fence—8 ft. Chain Link,” “Visual Barrier Fence—8 ft.,” and “Double Vehicular Chain Link Gate.”

Visual barrier fence shall be paid for in linear feet. Class AA Concrete to set fence posts is considered incidental to the bid item “Visual Barrier Fence—8 ft.”

The Contractor in constructing chain link and visual barrier fencing shall minimize the removal of existing vegetation to only that required for the completion of the fence construction. It is the intent that existing vegetation between the disturbed limits and existing right-of-way is to be left intact to help maintain visual screening for the adjacent property owners.

Security locks shall be required for all gates and shall be considered incidental to the bid item “Double Vehicular Chain Link Gate.”

All gates shall be locked at all times during non-working hours.

Upon completion of the Exploratory Tunnel construction and geotechnical investigation activities, the Contractor shall install a lockable portal security gate that completely covers the entrance to the tunnel portal and supply the Engineer with keys to this security gate. Payment at the contract unit price for “Portal Security Gate” shall be full compensation for all labor, materials, equipment, and incidentals required for installing and maintaining the portal security gate.

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SPECIAL NOTE FOR TEMPORARY LIGHTING

In addition to the requirements stated in Section 716 of the Department's 2004 *Standard Specifications for Road and Bridge Construction*, the Contractor is advised that the temporary lighting required for this project shall be maintained in working order for a period of eight (8) months after the contract has been called complete. This work shall be incidental to the bid item "Temporary Lighting."

Temporary Lighting shall include the following:

1. To minimize light trespass and glare for the adjacent residential areas from temporary worksite lighting, low-mast directional luminaires with cutoff capabilities shall be utilized.
2. Provide and maintain lighting for construction operations to achieve minimum lighting levels as required by NFPA and OSHA.
3. The Contractor shall supply and install a complete temporary lighting system including fixtures, poles, mounting hardware, power cable, etc. in accordance with all applicable national, state and local codes, and requirements. The Contractor shall submit temporary lighting plans, details, circuiting, etc. to the Engineer for review and approval.
4. Provide and maintain 5 foot-candles of exterior lighting in the Emergency Turnaround Area outside the Exploratory Tunnel portal. This lighting shall be supplied with dusk to dawn lighting control along with a manual shut-off switch.
5. Provide lighting in all construction lay down, batch processing, construction trailer, etc. areas. Lighting shall have dusk to dawn lighting control along with a manual shut-off switch. The Contractor shall minimize light trespass into residential areas.
6. Inspect each installed fixture for damage. Replace damaged fixtures and components. Maintain lighting and provide routine repairs.
7. Temporary tunnel lighting shall be provided in accordance with Section 01 51 00 - Tunnel Ventilation and Utilities of the Exploratory Tunnel Supplemental Specifications.

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SPECIAL NOTE FOR EMERGENCY TURNAROUND AREA

The Contractor shall maintain adequate open area at all times for emergency vehicle operation in the emergency turnaround area located at the Exploratory Tunnel portal. The emergency turnaround area shall not be used for parking, stockpiling of materials, or any other use that would prohibit free access and turning capabilities for emergency vehicles. See Plan Sheet R12 in the plans for further details.

Right-of-Way Certification Form

Federal Funded

State Funded

This form must be completed and submitted to FHWA with the PS&E package for federal-aid funded Interstate, Appalachia, and Mega projects. This form shall also be submitted to FHWA for all federal-aid projects that fall under conditions No. 2 & 3 outlined elsewhere in this form. For all other federal-aid projects, this form shall be completed and retained in the KYTC project file.

Date: April 20, 2007

Project #: _____

County: JEFFERSON

Item #: 5-731.00

Federal #: NH-2653 (018)

Letting Date: June 22, 2007

Projects that require NO new or additional right-of-way acquisitions and/or relocations

The proposed transportation improvement will be built within the existing rights-of-way and there are no properties to be acquired, individuals and families ("relocatees") to be relocated, or improvements to be removed as a part of this project. See Note No. 1 below.

Projects that require new or additional right-of-way acquisitions and/or relocations

Per 23 CFR 635.309, the KYTC hereby certify that all relocatees have been relocated to decent, safe, and sanitary housing or that KYTC has made available to relocatees adequate replacement housing in accordance with the provisions of the current FHWA directive(s) covering the administration of the Highway Relocation Assistance Program and that at least one of the following three conditions has been met. (Check those that apply.)

1. All necessary rights-of-way, including control of access rights when applicable, have been acquired including legal and physical possession. Trial or appeal of cases may be pending in court but legal possession has been obtained. There may be some improvements remaining on the right-of-way, but all occupants have vacated the lands and improvements, and KYTC has physical possession and the rights to remove, salvage, or demolish these improvements and enter on all land. Fair market value has been paid or deposited with the court.

2. Although all necessary rights-of-way have not been fully acquired, the right to occupy and to use all rights-of-way required for the proper execution of the project has been acquired. Trial or appeal of some parcels may be pending in court and on other parcels full legal possession has not been obtained, but an Interlocutory Judgment has been granted, the occupants of all lands and improvements have vacated, and KYTC has physical possession and right to remove, salvage, or demolish these improvements. Fair market value has been paid or deposited with the court for most parcels. Fair market value for all pending parcels will be paid or deposited with the court prior to start of construction. (See note.)

Note: The KYTC shall re-submit a right-of-way certification form for this project prior to the start of construction, verifying that fair market value for all parcels has been paid or deposited with the court.

Right-of-Way Certification Form



3. The acquisition or right of occupancy and use of a few remaining parcels are not complete and/or some parcels still have occupants. However, all remaining occupants have had replacement housing made available to them in accordance with 49 CFR 24.204. The KYTC is hereby requesting authorization to advertise this project for bids and to proceed with physical construction even though the necessary rights-of-way will not be fully acquired, and/or some occupants will not be relocated, and/or the fair market value will not be paid or deposited with the court for some parcels at the start of construction. KYTC will fully meet all the requirements outlined in 23 CFR 309(c) (3) and 49 CFR 102(j) and will expedite completion of all acquisitions, relocations, and full payments after construction starts. A full explanation and reason for this request, including identification of each such parcel and dates on which acquisitions, payments, and relocations will be completed, is attached to this certification form for FHWA consideration and approval. (See note.)

Note: The KYTC may request authorization on this basis only in unique and unusual circumstances. Proceeding to construction of projects on this basis shall be the exception and never become the rule. In all FHWA-approved cases, the KYTC shall make extraordinary efforts to expedite completion of the acquisition, payment for all affected parcels, and the relocation of all relocatees promptly 30 days after start of construction.

NOTE NO. 1:

This project is Section 4B of the Louisville-Southern Indiana Ohio River Bridges Project and consists of an Exploratory Tunnel and Access Ramp.

The Access Ramp construction is within existing rights-of-way. The Exploratory Tunnel is for geotechnical and geophysical investigations and doesn't require right-of-way as per KRS 416.560 (4).

Approved: *Sam Bryant* 4-20-07 District ROW Supervisor
Printed Name Approved

Approved: *Glenn H. Duff* 04-20-07 Director of ROW & Utilities or Designee
Printed Name Approved

Approved: *A. Phira Michael* 5/10/07 FHWA, Right-of-Way Officer
Printed Name Approved

LOUISVILLE- SOUTHERN INDIANA OHIO RIVER BRIDGES PROJECT

SECTION 4B EXPLORATORY TUNNEL

JEFFERSON COUNTY

Exploratory Tunnel Supplemental Specifications

July, 2007



Prepared by:



For:

Kentucky Transportation Cabinet

EXPLORATORY TUNNEL SUPPLEMENTAL SPECIFICATIONS

SECTION 00 01 10

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END OF SECTION

SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

- A. The Work specified in this Contract shall include but not be limited to, the following:
1. All Work necessary for portal slope construction from the access ramp excavation, reinforcement, rockfall protection and monitoring.
 2. All Work necessary for Exploratory Tunnel construction and excavation in rock from the portal.
 3. All Work necessary for Exploratory Bay excavation and construction by enlargement of the Exploratory Tunnel at locations and dimensions indicated on the Contract Drawings to accommodate exploration drilling equipment, instrumentation monitoring equipment and testing equipment.
 4. All Work necessary to perform a Geotechnical Exploration of the underground conditions
 5. The tunnel shall be excavated by drill and blast methods or optionally by mechanical excavation with acceptance by the Engineer. However, use of TBM equipment will not be allowed.
 6. The installation of initial support to ensure safety and stability of the excavation
 7. The tunnel shall be considered as being initially “potentially gassy” unless high enough gas concentration occurs during monitoring to render it “gassy”.
 8. Probe drilling shall be undertaken ahead of the tunnel heading and where necessary rock grouting will be undertaken.
 9. The anticipated geologic conditions are described in the Geotechnical Baseline Report and Geotechnical Data Report (GBR, GDR).
 10. Undertake inspection surveys of structures as defined in the Special Notes for the Contract.
 11. Remove all spoil by use of the access ramp, and transfer to road haulage vehicles for disposal.
 12. Design and install temporary construction facilities needed for the tunnel construction activities and subsequent geotechnical testing activities.
 13. Utilities specified herein will be required to remain in place after construction is completed for the maintenance and protection period.
- B. The primary purpose for the exploratory tunnel construction is to enable geotechnical investigation work to be undertaken. The nature of the Work on this Exploratory Tunnel contract should anticipate that will differ from other civil works tunnel projects, to the extent that exploration of the underground conditions is a major objective of the Contract, in addition to the expeditious excavation of an underground opening. This entails, but is not limited to, the execution of the following investigation Work for which the Contractor will be exclusively responsible or provide the services to the Engineer, the Cabinet or his agents as described in the relevant specification sections:
1. The measurement of ground water levels within existing observation wells and

stream courses accessible from the surface in the environs of the tunnel alignment.

2. Provide access and facilitate geotechnical mapping of excavated surfaces both during excavation and behind the heading of the tunnel excavation.
 3. Provision of safe access and services to conduct stereo-photogrammetric recording of the tunnel surface in combination with the geodetic determination of the camera positions.
 4. Measurement of instruments installed to monitor excavation, the installed support elements within the tunnel, and existing structures above and in the environs of the tunnel.
 5. The execution of geophysical investigation methods at specified intervals within the tunnel at intervals as excavation proceeds requiring the setting of instruments in holes drilled in the wall of the tunnel.
 6. The execution of exploration rotary drilling with core recovery and the exploration percussive open hole probe drilling within the tunnel remote from the tunnel heading.
 7. The provision of water spraying on a cyclical wetting and drying basis of exposed shale in the walls of certain exploration bays
 8. Monitoring of ground response.
 9. The execution of geophysical resistivity measurements in the invert of the tunnel.
 10. The provision of survey control to conduct settlement monitoring of Highway 42 and associated infrastructure adjacent to the highway prior to, during and subsequent to tunnel excavation beneath the highway.
 11. The execution of photographic survey of the tunnel excavation surface.
- C. The Work shall include all appurtenant Work necessary to complete the Work in accordance with the Contract Documents.
- D. Conduct ground vibration monitoring in response to construction and blasting and creation of air overpressure. The monitoring shall be performed in the presence of the Engineer for contract compliance. The results of such monitoring will be provided to the Engineer within one (1) business day.

1.2 TEMPORARY CONSTRUCTION UTILITIES TO BE LEFT IN PLACE

- A. The following temporary construction utilities, if applicable, shall be left in place in good, working condition:
1. Water and Fire Service
 2. Gas & Electric
 3. Sanitary & Sewer
 4. Cellular, Telephone & Facsimile
- B. The following equipment relating to the services of the Exploratory Tunnel and Access Ramp shall be handed over to the Cabinet upon final completion of this Contract:
1. Mechanical
 2. Electrical
 3. Drainage
 4. Ventilation
 5. Instrumentation and Monitoring

6. Sanitary Facilities

- C. Provide all repairs, replacements, and refinishing as required to hand-over operational equipment in accordance with OSHA standards. All incidental labor, materials and associated costs required to construct the project shall be included in the unit prices for the constructed items for this project.

1.3 WORK BY OTHERS

A. Existing Geotechnical Exploration

1. Ground Surface Data Produced by Others: Extensometer holes and piezometers drilled from the ground surface by others will exist. The instrument data as well as surface geophysical data will be provided to the Contractor by the Engineer, along with updated data from such instruments on a regular.

B. Additional Geotechnical Exploration

1. The Cabinet will engage a geotechnical consultant to perform additional surface geotechnical and geophysical programs along the tunnel alignment. This work will commence shortly after the Contractor's notice to proceed for approximately a 12-week duration. The Contractor will be required to coordinate and liaison with the consultant during this period. The Cabinet's Engineer will perform all readings and test data..
2. The instrument data as well as surface geophysical data will be provided to the Contractor by the Engineer, along with updated data from such instruments on a regular.

1.4 MEASUREMENT AND PAYMENT

- A. No separate measurement for payments included in this Section. All costs shall be included in the respective Sections pertaining to Work.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 32 23

TUNNEL SURVEYING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section describes the requirements for the setting out of the Work, survey control and measurement required for construction of the Work.
- B. Develop and implement surveying program capable of satisfying all Project survey and accuracy requirements. The Engineer shall review this program before commencement of the Work. The review shall in no way release Contractor of liabilities associated with or dependent on this part of the Work.
- C. Survey of tunnel station markers every 20 feet along the tunnel sidewall as defined in Section 31 71 16.01.
- D. Related Sections:
 - 1. Special Note For Submittal Procedures
 - 2. Section 01 40 00 Quality Requirements
 - 3. Section 02 32 13 Geotechnical Investigation in Exploratory Tunnel
 - 4. Section 31 09 13 Instrumentation and Monitoring
 - 5. Section 31 71 16.01 Tunnel Excavation by Drill and Blast

1.2 REFERENCES

- A. Definitions
 - 1. Position: of a structure or structural element shall be the horizontal position of its center line(s) and/or center point(s) in relation to the overall setting out of the Work as shown on the Drawings.
 - 2. Alignment: of a structure or structural element shall be the alignment of its center line(s) in relation to the overall setting out of the Work as shown on the Drawings. Deviation from true alignment shall be measured in degrees of an arc.
 - 3. Leading and Cross-Sectional Dimensions: of a structure or structural element shall be the dimensions relating to length, width, height, thickness, etc. which collectively determine its shape as shown on the Drawings.
 - 4. Level: of any structure or structural element shall be the level of the upper or lower surfaces as may be relevant with reference to the Bench Mark.
 - 5. Gradual Irregularity: is the maximum allowable value by which the surface tested may deviate from a 9-foot long straight edge or correctly shaped template placed at any position on the surface.

6. Abrupt Irregularity: is the maximum allowable abrupt step in any surface.

B. Reference Standards

1. Federal Geographic Data Committee, Document FGDC-Std-007-1998
2. Control datum for the survey is indicated on the Contract Drawings.

1.3 TOLERANCES

A. Where tolerances if any, detailed on the Drawings differ to those specified below, then those detailed on the Drawings shall apply.

B. Perform surveying to Second Order, Class 1 minimum accuracy of 1:50,000 as defined by the Federal Geographic Data Committee.

C. The tolerances given below shall be the maximum permissible deviations from the specified dimensions, levels, alignment, positions, etc. as shown on the Drawings or specified herein.

D. Tunnel

1. Alignment: ± 2 in.
2. Level: Center point of tunnel ± 2 in.

E. Exploration Bays

1. Position: ± 2 in.
2. Level: Center point of tunnel ± 2 in.
3. Initial Support Internal Dimensions ± 2 in.

F. Rock Reinforcement

1. Orientation:
 - a. Rock bolts $\pm 5^\circ$
 - b. Self Drilling Anchors $\pm 5^\circ$
 - c. Spiles $\pm 5^\circ$
 - d. Canopy tubes $\pm 2^\circ$
2. Position: ± 6 in

G. Steel Rib

1. Position longitudinally: ± 4 in.

H. Steel Rib Fabrication Tolerances

1. Chord, measured on centerline of rib: Theoretical length plus or minus 1/16 inch.
Face of butt or foot plates: Within plus or minus 1/16 inch of theoretical plane
2. Gap between ends of ribs and butt or foot plates prior to welding not exceeding 1/16 inch for at least 75 percent of the cross sectional area of the rib. Where gaps are in excess of 1/16 inch, fill by additional welding.
3. Tie rod holes in rib webs: Within plus or minus 3/8 inch of the locations shown on the Shop Drawings.
4. Width or length of shear plates: Within the theoretical dimensions plus or minus 1/8 inch.

5. Center to center of bolt hole dimensions on butt or splice plates: Theoretical dimension plus or minus 1/16 inch.
 6. Bolt hole groups in butt or splice plates after fabrication: Within plus or minus 1/16 inch of the theoretical location regardless of the variations in the rib resulting from other tolerances
- I. Steel Rib Bending Tolerances
1. Conformance to true template: Plus or minus 3/8 inch between end plates and plus or minus 1/8 inch in three-foot gauge depth.
 2. Bending curvature: Uniform.
 3. After bending:
 - a. Outer flange will be permitted to deflect 1/8-inch maximum toward the inner flange for radii of bend less than 14 times the rib depth.
 - b. Buckling of the web for a distance of 1/2 the rib depth from either end will be permitted with deviation from the flat no greater than plus or minus 1/8 inch for radii of bend equal to 14 times the rib depth or greater.
 - c. Buckling of the web for a distance equal to the depth of the rib from either end will be permitted with deviation from the flat no greater than plus or minus 3/16 inch for radii of bend less than 14 times the rib depth.
 - d. Rib depth at the web: Not less than the theoretical depth minus 1/4 inch.

1.4 SUBMITTALS

- A. Submittals shall conform to Special Note for Submittal Procedures.
- B. Qualifications of land survey supervisor(s) with detailed references made to projects requiring application of similar surveying procedures and techniques.
- C. Detailed description of proposed survey method, network diagrams, and equipment type accompanied by manufacturer's literature specifying probable accuracies, calibration procedures, requirements, and frequencies.
- D. Control station materials and methods of installation, preservation, and recovery.
- E. Mathematical pre-analysis to demonstrate that the required accuracies can be achieved using the proposed methods.

1.5 CLOSEOUT SUBMITTALS

- A. Submittal shall conform to Special Note for Submittal Procedures.
- B. Results of all surveys and measurements and of all verification, incremental control, and recovery surveys made accompanied by updated network diagrams.
- C. A complete and accurate log of control and survey Work as it progresses.
- D. As-built location survey records including, but not limited to, control diagrams, field notes, computer printouts, working sketches, tunnel cross sections, and final drawings.

1.6 QUALITY ASSURANCE

- A. Section 01 40 00 - Quality Requirements
- B. Planning and execution of this Work shall be conducted by a Licensed Land Surveyor registered in the State of Kentucky using only qualified personnel. Supervisor of the Work shall have a minimum of five years experience in at least two projects of similar magnitude in high-precision surveys acceptable to the Engineer.
- C. As-built surveys shall be stamped and sealed by Land Surveyor licensed in the State of Kentucky.
- D. Furnish skilled labor, instrument platforms, ladders, other temporary structures, special lights or group of lights and electric power, as necessary, for making and maintaining points, lines, and grades in connection with the surveys performed.

1.7 SCHEDULE OF BID ITEMS

- A. Measurement
 - 1. The Cabinet will make separate payment for the Contractor’s compliance with the surveying labor, material and equipment requirements of this Section including any and all incidentals to perform this work.
 - 2. The Cabinet will not measure surveying required to correct any errors or inaccuracies resulting from construction operations and will consider it incidental to this item of work.
- B. Payment
 - 1. The Cabinet will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Payment Item</u>	<u>Pay Unit</u>
22427NN	Tunnel Surveying	Lump Sum

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A. Furnish all labor, materials, tools and equipment, and perform all operations necessary for establishing and maintaining survey control points and baselines necessary to control the tunnel alignment (vertically and horizontally), instrumentation and monitoring (Section 31 09 13) and all parts of the Work within the specified tolerances, as indicated on the Contract Drawings, specified herein and in other Sections of these Specifications.

- B. Record all calculations for setting out and check surveying in a suitable permanent form, which shall be provided to the Engineer as the Work is undertaken. Erect, to the satisfaction of the Engineer, all necessary survey elements required for the proper alignment of the Work. Make all templates necessary for the proper setting out of the Work and support of items to be built in.
- C. Have available on Site at all times a sufficient number of properly maintained electronic distance measuring systems, levels, theodolites, laser equipment, accurate steel tapes, ranging rods, boning rods, and other instruments and appliances as may be necessary for the correct setting out of the Work and control of the construction.

3.2 SURVEY ACCURACY REQUIREMENTS

- A. It is the intent to obtain survey accuracy sufficient to ensure that the tunnel excavated, as determined by the survey, shall, in fact, be within the tolerances shown on the Contract Drawings and as specified.
- B. Tolerances of the Work are specified in other Sections of these Specifications.

3.3 SURVEY REFERENCES

- A. The Engineer has established basic survey control and reference points. Examine and verify locations of survey control points, and notify the Engineer of any discrepancies discovered within 48 hours of discovery and before starting the Work.
- B. Establish, verify, and maintain all such additional survey points required for the Work.
- C. At all times, protect, preserve, and maintain survey control points used for the Work. Report to the Engineer the loss, destruction, or relocation of any survey control point, and replace survey control points based on original survey control.
- D. Where a beacon or benchmark is likely to be disturbed during construction operations, establish suitable reference beacons or benchmarks at locations where they will not be disturbed during construction. No beacon or benchmark shall be covered, disturbed or destroyed before accurate reference beacons or benchmarks have been submitted to the Engineer and accepted.
 - 1. The Contractor's reference beacons or benchmarks shall be of at least the same quality and durability as that of the existing beacons and bench marks.
- E. Use equipment and implementation techniques such as forced centering at control stations as necessary to achieve required accuracies.

3.4 NETWORK DESIGN

- A. Design and implement a functional underground network, and determine all required measurements and the required accuracy of each measurement including horizontal angles, zenith angles, azimuths, distances, and height differences. Include analysis of

required redundancy and measure of internal reliability associated with each planned observation.

- B. Design and implement a functional surface control network, stations, positions, measurements, and accuracies. Measurements may include; horizontal and zenith angles, azimuths, distances, and height differences. Include analyses of required redundancy and measure of internal reliability associated with each planned observation.

3.5 VERIFICATION

- A. Every 500-feet along the tunnel verify the control survey using a total station.
- B. The Engineer will conduct its own verification survey. Assist the Engineer in such verification, allow the Engineer access, including all survey points, and provide transportation for workers and materials to and from the survey point locations.

3.6 CALIBRATION AND DATA PROCESSING

- A. Calibrate all instrumentation as required and as recommended by instrument manufacturer.
- B. Data reduction shall incorporate calibrations and meteorological correction, and reduction of measurements to the ellipsoid and thence to the Kentucky State Plan Coordinate System. Correct distance measurements by electro-optical distance measurement instrument (EODMI) for scale, cyclic error, zero error, and meteorological effects. Correct azimuths using the Laplace correction and include the effect of the deflection of the vertical components on angles and azimuth measurements.
- C. Data processing shall include least squares adjustments, as required. Employ data outlier detection. Determine horizontal and vertical confidence intervals.

3.7 CROSS-SECTION OF TUNNEL

- A. Establish to an accuracy of 2 inches the actual excavated tunnel profile every 10ft or advance length whichever is the lesser.
- B. Cross section profile shall be established by direct measurement, electronic or pulsed laser.
- C. Sufficient cross-sections are to be taken at exploration bays, areas of overbreak, etc. to be able to locate the excavated surface.

3.8 ADDITIONAL REQUIREMENTS

- A. Use a suitable proprietary laser system or approved equivalent to control the alignment of underground Work and shall use suitable precision survey equipment for setting out and check surveying.
- B. Control of Tunnel Photographic Survey

1. Provide a Survey Work Plan to meet the requirements of Section 02 32 13 for a tunnel photographic survey of the ground conditions encountered during construction.

END SECTION

SECTION 01 35 00

SAFETY PROCEDURES FOR TUNNEL CONSTRUCTION

PART 1 GENERAL

1.1 SUMMARY

- A. Initiate, maintain and supervise all safety programs in connection with the Work. Take all necessary precautions for the safety of, and provide the necessary protections to prevent damage, injury or loss to:
1. All employees associated with performing the Work
 2. All employees associated with monitoring and inspection of the Work
 3. Any authorized personnel or representative of the Cabinet
 4. All Work and all materials or equipment to be incorporated therein, whether in storage on or off the site
- B. No section or description in these documents shall be construed to replace, modify or supersede requirements of other codes, specifications and/or ordinances referenced throughout this document. In all operations, comply with all state, federal, and local ordinances, regulations, laws, and bylaws controlling such work.
- C. All Work shall comply with applicable provisions of 29 CFR Part 1926.800, Subpart S, "Underground Construction", by OSHA.
- D. Related Sections:
- | | | |
|----|---------------------|--|
| 1. | Special Note | For Temporary Site Facilities and Controls |
| 2. | Special Note | For Blasting and Vibration |
| 3. | Section 01 51 00 | Tunnel Ventilation and Utilities |
| 4. | Section 31 71 16.01 | Tunnel Excavation by Drill and Blast |
| 5. | Section 31 71 16.02 | Blasting |
| 6. | Section 31 71 23 | Mechanical Tunneling Excavation |
| 7. | Section 31 71 29 | Control and Removal of Tunnel Water |
| 8. | Section 31 72 13 | Rock Reinforcement and Support |

1.2 REFERENCES

- A. Reference Standards
1. OSHA 29 CFR 1926.800 Subpart S, "Underground Construction".
 2. The Kentucky Occupational Safety and Health Administration, under the statutory authority of KRS Chapter 338.

1.3 PERFORMANCE REQUIREMENTS

- A. Have the sole responsibility for the safety and training of persons engaged on the project and the sole liability for injuries to, or death of persons, or damage of property during the entire construction period.

- B. Have on hand at all times sufficient materials and equipment in good condition and in good working order for all emergencies that are likely to arise to secure the safety of all personnel and structures.
- C. All Work shall be performed in accordance with OSHA requirements with particular reference to 29 CFR 1926.800, Subpart S, and entitled "Underground Construction". Should there be any conflict between this Specification and OSHA requirements, the more restrictive shall apply.
- D. Safety Officer:
1. Be responsible for the safety of the Contractor's employees, Cabinet and Engineer's personnel and all other authorized personnel at the site of the Work.
 2. Have a competent, OSHA-certified Safety Officer(s) on the job a minimum of three (3) days per week, with an appropriate office on the job site to maintain and keep available safety records and up-to-date copies of all pertinent safety rules and regulations. In absence of the Safety Officer not being on site, the Project Manager shall be the designee and fulfill all requirements of this Section.
 3. The Safety Officer shall:
 - a. Report directly to the Contractor's Project Manager.
 - b. Ensure compliance with all applicable health and safety requirements of all governing legislation.
 - c. Schedule and conduct safety meetings and safety training programs as required by law and this Specification for all personnel engaged in the Work.
 - d. Post all appropriate notices regarding safety and health regulations at locations that afford maximum exposure to all personnel at the job site.
 - e. Post the name address and hours of the nearest medical doctor; names and addresses of nearby clinics and hospitals; and the telephone numbers of the fire and police departments.
 - f. Post appropriate instructions and warning signs with regard to all hazardous areas or conditions.
 - g. Have proper safety and rescue equipment adequately maintained and readily available for any contingency. This equipment shall include items such as: fire extinguishers, first aid kits, safety ropes and harnesses, stretcher, life savers, oxygen breathing apparatus, resuscitators, gas detectors, oxygen deficiency indicators, explosion meters, and any other equipment mandated by law.
 - h. Make daily inspections in accordance with an inspection checklist report form to ensure that all machines, tools and equipment are in safe operating condition; that all Work methods are not dangerous; and that all Work methods are free of hazards.
 - i. Submit to the Engineer copies of all inspection checklist report forms, safety records and all safety inspection reports and associated certifications from regulating agencies and insurance companies.
 - j. Notify Engineer of any serious accident immediately, followed by a detailed written report within twenty-four (24) hours. "Serious accident" is defined as that requiring an absence of work of more than 2 days and/or hospitalization.

- k. Notify the Engineer immediately in the event of a fatal accident.
 - l. Notify the Engineer of any accident claim against the Contractor or any Subcontractor immediately, followed up by a detailed written report on the claim and its resolution.
 - m. Review safety aspects of the Contractor's submittals as applicable.
 - n. As required by 29 CFR 1926.800, maintain records of gas testing within the tunnel, calibration of gas testing equipment and inspections of self rescuers.
 - o. Create Job Hazard Analysis (JHA) and review with crews.
- E. All personnel employed by the Contractor or his Subcontractors whenever entering the job site, shall be required to wear approved safety hats as well as protective and hi-visibility clothing, footwear, eyewear, ear protectors and other equipment as required by OSHA and as outlined in the site specific Contractor's Health and Safety Plan. Maintain, on site, a sufficient number of safety hats and other personnel protective equipment for the use of authorized personnel. Supply the Cabinet and Engineer's personnel with the same equipment and training to ensure a common standard.
- F. Where Work is in progress in the tunnel or for excavations more than 10 feet in depth, Provide as a minimum the following safety equipment:
- 1. Adequate stretcher units placed in convenient locations adjacent to the Work;
 - 2. Oxygen deficiency indicators;
 - 3. Carbon Monoxide testers;
 - 4. Hydrogen Sulfide detectors;
 - 5. Portable explosimeter for the detection of explosive gases such as methane, petroleum, vapors, etc., complete with probe for measuring in roof cavities.
 - 6. All personnel entering the underground Work shall be issued with an OSHA/NIOSH approved self rescuer of the Self Contained type (SCSR) such as the 'Oxy-K Plus' manufactured by Draeger Safety or other approved equivalent.
 - 7. All personnel entering the underground Work shall be issued with an MSHA approved personal cap lamp, which shall be carried at all times.
- G. An additional explosimeter shall be provided at the heading at all times that will continuously monitor for the presence of explosive gases. This explosimeter shall be the type that automatically provides both visual and audible alarms.
- H. No employees will be allowed to Work in areas where concentrations of airborne contaminants exceed federal threshold limits. Respirators shall not be substituted for environmental control measures and shall be used only as prescribed by OSHA.
- I. Maintain tunnel air in a condition suitable for the health of the workers at all times per Section 01 51 00. Ventilating plants shall be of ample capacity as a minimum in conformance with OSHA requirements, and shall be installed and operated throughout the duration of the Contract.
- J. The entire ventilating system shall be maintained in a good condition and shall be under the direction of an employee experienced in tunnel ventilation operation and maintenance per Section 01 51 00. A supply of fresh air shall be furnished for the quick removal of fumes and dust generated by tunnel operations. If using an exhaust ventilation system, the

exhausted air shall be washed and filtered to remove excess dust particles resulting from excavation, before discharge to the atmosphere.

- K. Provide an emergency generator or other source of standby power to enable the safe evacuation of the tunnel in the event of a failure of the main power supply per Section 01 51 00.
- L. Supply a storage unit containing a cache of additional SCSRs. This shall be located in the tunnel and advanced as excavation proceeds. The SCSR storage unit may be located in an exploration bay. It must be located as near to the tunnel heading as practicable, while being protected from blasting debris. The storage unit shall contain at least as many SCSRs as the number of personnel expected to be present in the tunnel and maintained in good working order. These are in addition to the SCSRs issued to personnel entering the tunnel as required by Subsection 1.3.F.6 of this Section, and shall be of the same type.
- M. Provide continuous monitoring for toxic and explosive gases, in accordance with Subsection 1.5 of this Section, at the working heading and at other locations within tunnels where Work is in progress. Take all possible safety precautions as the Work progresses under these conditions and increase ventilation to the extent that explosive and toxic mixtures are not allowed to form.
- N. Rapid excavation machinery in Section 31 71 23 shall have an automatic shut-off that will be activated if dangerous levels of gases are detected.
- O. Internal combustion engines other than mobile diesel powered equipment shall not be used underground. All diesel powered mobile equipment used underground shall be as prescribed in OSHA and be operated in compliance with OSHA regulations. Submit, upon request, proof of certification to the Engineer. All internal combustion equipment allowed under this Section shall be operated in such a manner as to prevent health hazards to personnel from exhaust fumes.
- P. All haulage equipment shall conform to all requirements described in OSHA.
- Q. Conduct all tunneling operations by methods and with equipment that will positively control dust, fumes, vapors, gases, fibers, fogs, mists, or other atmospheric impurities in accordance with OSHA requirements.
- R. Fire Prevention and Control: All underground construction shall be performed in accordance with the applicable fire prevention and control requirements of OSHA, and local fire department ordinances.
- S. Noise and Dust Control: Control noise and dust in accordance with applicable federal, state and local laws, safety codes, regulations and ordinances.
- T. Muck Handling: Provide spill protection and emergency cut offs for muck conveyor systems, if used per requirements of Section 31 71 16.01.
- U. Maintain the stability of the excavation around the periphery of all underground Work per Sections 31 71 16.01, 31 71 23 and 31 72 13.

- V. Arrange liaison meetings with the local emergency enforcement authorities before commencement of Work and at regular intervals during the Work.

1.4 BLASTING IN TUNNEL

- A. Conduct all blasting operations in conformance with Section 31 71 16.02 – Blasting and Special Note for Blasting and Vibration.

1.5 SUBSURFACE GASES

- A. The tunnel shall be considered as being initially “potentially gassy” unless high enough gas concentration occurs during monitoring to render it “gassy”.
- B. Anticipate that combustible and toxic gases will be encountered during tunneling operations and take the necessary measures to provide for safety which, at a minimum, shall comply with all OSHA regulations and in particular with the requirements set forth in the recently revised regulatory 29 CFR Part 1926, Subpart S, “Underground Construction”. Provide the following:
 - 1. Install and maintain gas analyzers and continuously monitor for combustible, noxious and toxic gas at each working heading and at other locations where gases may accumulate or Work is in progress, as well as at any other locations required by OSHA. Any tunnel excavating machine used shall be fitted with a combustible gas analyzer (CGA) that continuously monitors methane and other flammable gas concentrations at the excavation heading. The CGA shall sound audible alarms and activate warning lights when methane or other flammable gases are detected in excess of 5% of the lower explosive limit (LEL).
 - 2. Fixed and equipment-mounted gas analyzers shall be connected so as to de-energize mains electrical circuits on the tunnel excavating machine and other electrical circuits or devices not approved for use in hazardous conditions when combustible gas concentrations exceed a designated threshold (not more than 20 percent of their lower explosive limit). Portable CGA shall be provided as a backup to the equipment mounted unit(s).
 - 3. Provide continuous tunnel ventilation in accordance with Subsection 1.3 (J) and (K) of this Section.
 - 4. In addition, provide adequate ventilation and suppression measures to the heading to prevent accumulation of dust, fumes, mists, vapors or gases.
 - 5. Monitor the exhaust for toxic and explosive gases and where an exhaust ventilation system is used shall extend the outlet by 10 feet or more, or as required by Local Regulations above existing grade to disperse any gas encountered. Monitoring shall be continuous.
 - 6. In addition to the ventilation requirements described above, provision shall be made to increase ventilation air volume to control gas concentrations.
 - 7. Nothing in these requirements shall be construed to conflict with or otherwise diminish the Contractor's obligations to comply with OSHA regulations.

1.6 WATER IN TUNNEL

- A. Expect groundwater in the tunnel, with quantities as described in the GBR. Make due provision for the handling and control of the expected quantities of water. Refer to

Section 31 71 29 - Control and Removal of Tunnel Water and Special Note For Temporary Facilities and Controls.

1.7 SUBMITTALS

- A. Submittal shall conform to Special Note for Submittal Procedures.
- B. Safety Officer - Submit a resume of the qualifications of the Safety Officer within thirty (30) days prior to the start of any site Work. This resume shall include a description of the Safety Officer's experience, education, and special safety and first aid courses completed, and safety conferences attended, and shall indicate that the individuals possess safety experience in heavy construction and underground construction.
- C. Health and Safety Plan (HASP) - 30 days prior to the commencement of site Work, submit full health and safety plan to the Engineer in accordance with OSHA requirements. A Certified Industrial Hygienist (CIH) shall verify the HASP.
- D. In addition to the specific OSHA requirements, The Health and Safety Plan shall include but not be limited to:
 - 1. Induction Training to be provided to employees and authorized personnel.
 - 2. Schedule of Planned Tool Box Training Talks.
 - 3. An assessment of the likely heat release rate and location of potential fires.
 - 4. An assessment of the need for emergency generators or other standby power source.
 - 5. Tunnel emergency evacuation procedures in the event of fire, flood, oxygen deficiency or presence of gas. The HASP shall also address eventuality of evacuation/rescue in the case of collapse, accident or other significant events. Reference shall be made to the Incident Response Plan.
 - 6. Hot Work Permit system for control of welding and burning operations in the underground Work. This shall include a system for the control and monitoring of locations of gas bottles in the tunnel.
 - 7. Job Hazard Analysis for all major activities.
 - 8. Personal protective equipment requirements.
 - 9. Methods of Dealing with Contaminated Material (if any).
 - 10. Samples of report formats for all monitoring and reporting required by the Specification.
 - 11. Item by item statement of compliance with relevant part sections of 29 CFR 1926.800 with explanations of how compliance will be achieved.
 - 12. Security procedures for maintenance period following completion of tunneling and geotechnical Work. This shall also include tunnel re-entry procedures for inspection and maintenance purposes.

1.8 MEASUREMENT AND PAYMENT

- A. Measurement
 - 1. Tunnel Safety Monitoring and Training
 - a. The Cabinet will measure the Work as detailed in the units listed in the Payment Subsection.
 - b. The Cabinet will not measure labor for safety monitoring, training, and

record-keeping for payment and will consider it incidental to this item of work.

- 2. Tunnel Safety Equipment and Maintenance
 - a. The Cabinet will measure the Work as detailed in the units listed in the Payment Subsection, including:
 - 1) Labor; installation; installation tools and equipment; manufacturer's products; component parts and devices, maintenance.

- B. Payment
 - 1. The Cabinet will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Payment Item</u>	<u>Pay Unit</u>
22425NN	Tunnel Safety Monitoring and Training	Lump Sum
22426NN	Tunnel Safety Equipment and Maintenance	Lump Sum

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Quality control and control of installation
- B. Tolerances
- C. References
- D. Testing and inspection services
- E. Manufacturers' field services

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' recommended installation procedures.
- C. When manufacturers' procedures conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Working Drawings or as directed by manufacturer.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of materials to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

1.4 REFERENCES

- A. For products or workmanship specified by associations, trades, or other consensus standards, comply with their standard requirements, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- E. Contractual relationships, duties, responsibilities of parties in Contract, responsibility of the Engineer shall not be altered from the Contract Documents by mention or inference otherwise in reference documents.
- F. Special Note for Submittal Procedures

1.5 TESTING AND INSPECTION SERVICES

- A. Employ and pay for services of an independent testing agency or laboratory acceptable to Cabinet to perform specified testing.
 - 1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer, technician or responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.
- B. The independent testing agency or laboratory will perform tests, inspections and other services specified in individual specification sections and as required by the Engineer.
 - 1. Laboratory: Authorized to operate in Commonwealth of Kentucky.
 - 2. Laboratory Staff: Maintain full time registered Engineer on staff to review services.
 - 3. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Engineer.
- D. Reports and data shall be submitted by an independent testing agency or laboratory to the Engineer and Contractor, per requirements of Special Note for Submittal Procedures indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
 - 1. Submit final report indicating correction of Work previously reported as non-compliant.

- E. Cooperate with independent testing agency or laboratory; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Engineer and independent testing agency or laboratory 12 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with independent testing agency or laboratory and pay for additional samples and tests required for Contractor's use.
- F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent testing agency or laboratory on instructions by Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Price.
- H. Independent Inspection Agency or Laboratory Responsibilities:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
 - 6. Perform additional tests required by Engineer.
- I. Independent Inspection Agency or Laboratory Reports: After each test, promptly submit copies of report to Engineer and Contractor per Special Note Submittal Procedures. When requested by Engineer, provide interpretation of test results. Include the following:
 - 1. Date issued
 - 2. Project title and number
 - 3. Name of inspector
 - 4. Date and time of sampling or inspection
 - 5. Identification of product and specifications section
 - 6. Location in Project
 - 7. Type of inspection or test
 - 8. Date of test
 - 9. Results of tests
 - 10. Conformance with Contract Documents
- J. Limits On Testing Authority:
 - 1. Independent Inspection Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Independent Inspection Agency or laboratory may not approve or accept any portion of the Work.
 - 3. Independent Inspection Agency or laboratory may not assume duties of Contractor.

4. Independent Inspection Agency or laboratory has no authority to stop the Work.

1.6 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship and to initiate instructions when necessary.
- B. Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer subject to approval of Engineer.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.7 MEASUREMENT AND PAYMENT

- A. The Cabinet will measure this work by lump sum, including all work as described in Section 113—Quality Control/Quality Assurance, of the Standard Specifications, and in addition the work described in this supplemental specification.
- B. Payment:
 - 1. The Cabinet will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Payment Item</u>	<u>Pay Unit</u>
22580NN	QC, Exploratory Tunnel	Lump Sum

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

- 3.1 The Contractor shall take responsibility for the quality of construction and materials incorporated into the work and perform all quality control inspections, sampling, and testing of materials incorporated as part of the exploratory tunnel construction. The Cabinet may use the verified results of the Contractor’s inspection, sampling, and testing as part of its acceptance procedures provided the Contractor maintains a Department-approved Quality Control Plan (QCP).
 - A. The Contractor shall perform the requirements as stipulated in Section 113—Quality Control/Quality Assurance in the Department’s Standard Specifications for all work associated with the exploratory tunnel.
 - B. In addition to the requirements as stipulated in Section 113—Quality Control/Quality Assurance in the Department’s Standard Specifications, the Contractor shall perform the measures as outlined in this Supplemental Specification 01 40 00—Quality Requirements.

3.2 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Starting new Work means prior acceptance by the Engineer of existing conditions.
- B. Verify existing substrate is capable of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections are completed prior to starting new work.
- D. Verify utility services are available, in proper working order and in correct locations.

END OF SECTION

SECTION 01 51 00

TUNNEL VENTILATION AND UTILITIES

PART 1 GENERAL

1.1 SUMMARY

- A. The Work specified in this Section includes the design, procurement, installation, operation of all temporary facilities required for the potentially gassy exploratory tunnel construction including but not limited to the following:
1. Ventilation, spot cooling as required, dust removal and maintenance of acceptable air quality and environmental conditions, including the providing of sufficient ventilation flow for dispersion, dilution and exhaust of contaminated materials that may enter the tunnel through groundwater flows and seepage. The ventilation system will also provide for dispersion, dilution and exhaust of fumes from equipment operation and other activities within the tunnels as well as evacuation of blast fumes.
 2. Lighting along the length of tunnels and in the vicinity of all equipment for safe operations.
 3. Mine paging/communication system in tunnels.
 4. Water and compressed air for construction, fire protection systems including an exterior Siamese connection and check valve with fire drops located at each exploration bay location for fire departments use.
 5. Overlapping or redundant, independent discharge lines and intermediate, independent, redundant sump pumps to convey groundwater inflows, fire protection water and other construction water from the tunnels.
 6. Electric lines and transformers as required for operation of lighting, communications equipment and other construction equipment such as muck cars, pumps and ventilation equipment and etcetera.
 7. Emergency generator(s)/power for operation of essential equipment in case of general power outage.
 8. Tunnel lining attachment details for temporary facilities.
 9. Gas Monitoring devices
 10. Fire extinguishers and cabinets.
- B. All Work specified in this Section shall be the Contractor's responsibility. All Work shall comply with all applicable federal, state and local codes, laws, regulations and ordinances.
- C. The facilities to be provided include, but are not limited to, the following items: fans, ventilation ducting, pumps, piping, water, compressed air, lighting, components for hanging, fastening, and securing the facilities, power supplies, controls, monitors, communication lines and heating facilities if required.
- D. A firm with a minimum of three years of experience, all in the last five years, designing ventilation and electrical facilities for tunnel construction, shall design the facilities under the direction of a professional engineer registered in the Commonwealth of Kentucky.

The firm shall be operated and maintained by personnel with a minimum of three years of experience within the last five years.

- E. Electrical equipment including switches, panelboards, transformers, receptacles, motors, lighting, etc. shall be suited for the potential gassy classification per OSHA; and shall be installed in accordance with NFPA 70, NFPA 70E, NFPA 241 as well as OSHA 1926 requirements. If during the construction process of the exploratory tunnel it is found through monitoring that the tunnel is to be classified as “gassy” per the OSHA standards then all electrical material and installation methods will need to be reinstalled as required to be suited for “gassy” areas as described by OSHA standards and be suitable for Class I, Div.2 areas as per Article 501 of the NEC.
- F. Related Sections:
 - 1. Special Note Temporary Site Facilities and Controls
 - 2. Special Note Maintenance and Protection of Project Site

1.2 REFERENCES

- A. Reference Standards
 - 1. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), Construction Standards and Interpretations, 29 CFR Part 1926:
 - a. OSHA -Subpart S, Section 1926.800, “Underground Construction” and its referenced subparts and sections.
 - b. OSHA -Subpart K, Section 1926.400 through 1926.499 “Electrical” and its referenced subparts and sections.
 - c. OSHA - Subpart D, Section 1926.56 “Illumination” and its referenced subparts and sections.
 - d. OSHA -Subpart F, Section 1926.150 “Fire Protection and Prevention” and its referenced subparts and sections.
 - 2. Kentucky Occupational Safety and Health Administration standards for the Construction Industry
 - 3. U.S. Department of Labor, Mine Safety and Health Administration, (MSHA), 30 CFR Part 7, Subpart B, “Brattice Cloth and Ventilation Tubing”.
 - 4. National Fire Protection Association:
 - a. NFPA 70 – National Electrical Code, 2005
 - b. NFPA 70E – Standard for Electrical Safety in the Workplace, 2004
 - c. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations, August 29, 1993.
 - 5. NEMA – National Electrical Manufacturers Association – NEMA 250-1997 Enclosures for Electrical Equipment
 - 6. All other federal, state and local requirements and regulations in effect at the time of construction.

1.3 SUBMITTALS

- A. Submittal shall conform to Special Note for Submittal Procedures.
- B. The following specific information shall be provided at least 30 days prior to the commencement of installation of the temporary tunnel utilities:

1. Layout, details and specifications for all ventilation components, including but not limited to: locations, sizes, manufacturer's operating manuals, operating configurations, ducting, methods of joining lengths of duct together, method of suspending the ducts, noise attenuation devices, fan noise performance data, fan pressure / performance curves, control and operating systems.
 2. Staged ventilation plan showing minimum volume of fresh air to be supplied to the working area of the tunnel and minimum distance from the end of the duct to the working face.
 3. Details of all airflow and pressure monitoring equipment together with a schedule for proposed air quality measurements at the face and at other working areas away from the face
 4. Layout, details and specifications of all the tunnel utilities.
 5. Submit temporary lighting plans, details, circuiting, etc. for review and approval.
 6. Details and layout of all water flow monitoring equipment to be installed to provide data on the volumes of water used in the Contractor's operations, which is subsequently collected, pumped and treated as construction water
 7. Details and layout of communications system.
 8. Gas monitoring devices for potentially gassy classification.
 9. Fire protection systems and devices.
- C. The following documentation shall be submitted in a format agreed by the Engineer during the construction and maintenance period:
1. Air quality measurements shall be submitted on a daily basis during excavation and lining. During the maintenance period air quality measurements shall be taken before any personnel enter the tunnel for any reason and provided to the Engineer thereafter.
 2. All tunnel construction water flow monitoring data shall be submitted both electronically and hard copy on a weekly basis.
 3. All airflow monitoring and ventilation system performance data shall be submitted both electronically and hard copy on a weekly basis.

1.4 PERFORMANCE REQUIREMENTS

- A. In designing the tunnel facilities the Contractor should be aware that there are certain areas of the tunnel and exploration bay excavation perimeter where geotechnical instrumentation will be installed. These exclusion areas are indicated on the Contract Drawings and the design and routing of tunnel facilities should take this into account.
- B. The design of the ventilation system shall be designed taking into account, but not limited to, the following:
1. Quantities of air required by OSHA.
 2. Ventilation system shall provide for reversible airflow. The proposed ventilation system should not be reliant on the use of underground fans, with the exception of any fan or fans for flow reversing arrangements.
 3. Safety consideration dictated in referenced codes and standards.
 4. Dispersion and dilution of contaminated gases and flammable, explosive or other hazardous gases or materials.
 5. Tunnel Geometry: Depth, length, cross section.

6. Ambient Conditions: External summer and winter climate, in-situ rock temperature, water infiltration.
7. Maximum number of personnel in tunnel, including Contractor's, Cabinet's and Engineer's personnel.
8. Number and types of equipment in the tunnel, and their effects on air quality and temperature.
9. Water sprays for dust control; ventilation of tunnel face; and removal of dust from the ventilation air.
10. Friction losses, loss of air through duct leakage, minimum air velocity in the tunnel.
11. Removal of blasting fumes.
12. Phasing of the systems as the tunnel advances.
13. Local ventilation requirements at locations of welding, shotcrete placement, geotechnical investigations at exploration bays etc. and elsewhere, as required.
14. Fire resistance and electrical safety.
15. Sizes of diesel and electrical motors used in underground equipment during excavation and instrumentation installation operations.

1.5 MEASUREMENT AND PAYMENT

A. Measurement

1. The Cabinet will measure the Work for Tunnel Ventilation and Utilities, During Excavation as detailed in this Section, to include: design; labor; installation; installation tools and equipment; manufacturers' products; and component parts and devices as the tunnel excavation progresses, acceptably performed.

B. Payment

1. The Cabinet will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Payment Item</u>	<u>Pay Unit</u>
22233NN	Tunnel Ventilation and Utilities, Installation	Lump sum
22234EN	Tunnel Ventilation and Utilities, During Excavation	Linear foot

PART 2 PRODUCTS

2.1 GENERAL

- A. Materials may be new or used, shall be adequate and shall satisfy requirements for codes and regulations pertaining to the system. Tunnel support equipment and materials, including but not limited to utilities, shall be made of such materials and maintained in such a manner so as not to impair production or expose workers to safety hazards due to deterioration of the components or support equipment. Equipment and utilities within the tunnel shall also be so designed, fabricated, maintained and operated in such a manner to avoid accidents due to explosion or fire resultant from the equipment operation.
- B. Select equipment and components that will be resistant to water damage and deterioration under the conditions of the Project.

- C. Procurement of electrical power, water for tunnel fire hose drops and construction activities, sanitary facilities and communications system shall be the Contractor's responsibility

2.2 VENTILATION AND AIR MONITORING EQUIPMENT

- A. Select sizes of fan(s) to provide the minimum required airflow at the inlet.
- B. Select ventilation duct design for maximum airflow and minimum air leakage and resistance to fire hazards. Total leakage along the duct line shall not exceed one half of the air volume flow in the duct at the inlet. All bends shall be formed of rigid duct materials.
- C. Air monitoring equipment shall be provided for a potentially gassy tunnel in accordance with OSHA 1926.800 and NFPA 241.
- D. Ventilation ducting and brattice cloth shall be fire-resistant to MSHA, Part 7 of Title 30 Code of Federal Regulations. If the Contractor proposes to use the ventilation system to control smoke during a fire, the duct shall be capable of remaining intact in the event of a fire to the extent required for the proposed smoke control system.
- E. Tunnel ventilation fan(s) shall be explosion proof and shall continue to operate during an air monitor alarm condition.

2.3 ELECTRICAL MATERIAL AND EQUIPMENT

- A. Provide all material and labor required to route temporary power from the main temporary site construction power, as specified in Special Note for Temporary Facilities and Controls, to the temporary electrical distribution system for the exploratory tunnel. Once inside the tunnel all equipment and its installation shall be suited for potentially gassy classification per OSHA and shall be installed in accordance with NFPA 70. In the event that the tunnel is monitored and found to be "gassy" as defined by OSHA then the requirements stated in Section 1.1, (E) shall apply.
- B. Provide all panelboards, receptacles, step-down transformers, disconnect switches, enclosed circuit breakers, motor starters, feeders, branch circuit wiring, etc. as required for construction operations including tunneling equipment, ventilation, compressed air, sump pumps, tunnel lighting, communications equipment, monitoring equipment, etc.
- C. In addition to the power required as described in Item B, furnish and install the following equipment in each of the five exploration bays along the tunnel length, in a location directed by the Engineer.
 - 1. Provide a NEMA 3R, 480 volt, 60 amp., 3 pole, fused disconnect switch which supplies power to a NEMA 3R, 60 amp pin and sleeve type receptacle.
 - 2. Provide a 7.5kva, 480 –240/120 volt, 1 phase totally enclosed transformer with a NEMA 3R enclosure.
 - 3. Provide a NEMA 3R, 480V, 20A feeder to supply a 2 pole, 30A fused disconnect switch with 20 amp fuses to serve as a primary over current protection for the 7.5 kva stepdown transformer.

4. Provide a NEMA 3R Panelboard with a 30A main circuit breaker and 2-20A GFI (5ma) 1-pole breakers and 2 – 20A, 1-pole standard breakers.
 5. Provide a 120 volt, 20 amp GFI Type receptacle in a weatherproof enclosure fed from a 20 amp breaker located in the NEMA 3r panelboard.
 6. Provide a minimum illumination level of 15 footcandles in the exploratory bays.
- D. Provide flexible power cords as required for portable construction tools and equipment.
- E. Inspect each installed lighting fixture for damage. Replace damaged fixtures and components. Maintain lighting and provide routine repairs.
- F. Minimum illumination in the tunnel shall be in accordance with OSHA 1926, Subpart D, Table D-3.

2.4 TEMPORARY COMMUNICATIONS SYSTEM

- A. Temporary Communications System shall comply with OSHA regulations and standard 1926.800 (f) 1 through 5.

PART 3 EXECUTION

3.1 GENERAL

- A. Systems shall be installed in a neat and orderly manner, made structurally, mechanically and electrically sound, maintained to provide safe, continuous service at required times and to the minimum requirements outlined in these specifications, and modified and extended as work progresses.
- B. Fresh air must be supplied to all underground work areas in sufficient amounts to prevent any dangerous or harmful accumulation of dust, fumes, vapors, or gases in accordance with OSHA requirements.
- C. Install the electrical power, lighting, communication, and instruments in accordance with NFPA 70.

3.2 OPERATION

- A. Control of the ventilation systems shall be at ground surface; appropriate delays and interlocks shall be provided for proper sequencing and operation of fans, including reversal of fans.
- B. The exhaust/intake of the fans shall be kept clear of surface engine exhausts.
- C. Lighting, ventilation, fire protection, and gas monitoring facilities shall be left in the tunnel upon completion of the Work and maintained in working condition in accordance with the Special Note for Maintenance and Protection of Project Site.

- D. Provide and maintain communication systems in accordance with Subsection 3.3.C below.
- E. Monitor and provide air flow measurement data on a weekly basis and submit the results to the Engineer, in a form and format accepted by the Engineer, demonstrating that the ventilation system is providing airflow in compliance with the minimum requirements outlined in these specifications.

3.3 FIRE SAFETY

- A. General: Appropriate portable fire-suppression equipment shall be provided in all underground work areas in accordance with NFPA 241.
- B. Conveyor Systems (If used):
 - 1. The drive motor stations of horizontal conveyors shall be protected either by water or dry chemical protection. Booster drives, splicing stations, tail pulleys, and other fixed pieces of equipment on horizontal conveyors and related assemblies used underground shall be protected by fixed fire sprinklers or other means. Provide means of testing all systems.
 - 2. A recognized testing laboratory to determine the exact fire propagation index shall test samples of the conveyor belt materials to be used. The results of the tests shall be used for emergency planning purposes.
 - 3. All belt conveyors used underground shall be equipped with pulley slippage systems designed to shut down the belt if sliding friction develops between the drive pulley(s) and the belt. The slippage system shall be inspected in accordance with the manufacturer's recommendations.
 - 4. All conveyor belt systems shall be equipped with interlock(s) compatible with all conveyor system components, which shall shut down belt conveyors if any conveyor in the system should stop or reduce its normal speed or upon activation of a conveyor-related fire protection system.
 - 5. Fixed combustible materials such as posts, cribbing and roof supports shall be either metal guarded from contact by conveyor belt(s) or located at least half the width of the belt for an idler or pulley. Machinery guarding in the drive area and at other points along the belt shall be of non-combustible material.
 - 6. Belt conveyors shall utilize structures that do not provide a deck between the upper and lower strands of belt except at necessary transfer points and belt splicing locations. Structures at transfer points and belt-splicing locations shall not be constructed in a manner that will cause hazardous accumulations of material.
- C. Communication Systems:
 - 1. Voice communication shall be provided between the surface and underground work areas at all times. The communications system may be by a fixed wire or telephone system. Suitable protection shall be provided for each communication device location. Communication devices shall be installed at each exploration bay location.
 - a. Emergency communications within and outside the tunnel shall be capable of contacting Louisville Jefferson County Emergency

Management Agency/MetroSafe emergency staff member. Coordinate this with:

Louisville Jefferson County Emergency Management
Agency/MetroSafe
410 South 5th St., 2nd floor
Louisville, KY 40202
Contact: Ronald Pannel
502-574-2440
ron.pannel@impd.loukymetro.org

2. The Engineer's field office shall be provided with one fixed-wire device dedicated to maintaining communication with the underground work area at all times.
 3. Fixed communications wiring and equipment shall be located away from fire sources such as, but not limited to, transformer and conveyor systems.
 4. Fixed wire communications equipment along the tunnel alignment shall be located as to avoid unnecessary reaching or climbing on the tunnel walls for access.
 5. Where radio system(s) are used for emergency communications, repeater systems shall be so installed and located as to ensure uninterrupted and audible communications between the surface and underground work locations.
 6. Test all communications equipment (primary and secondary) weekly and maintain a record of the tests for the duration of the Work.
- D. Electrical Systems: Electrical power supplying critical operating equipment to support evacuation of persons from the underground work area(s) such as, but not limited to, pumping, communications, and hauling equipment, shall be redundant. Redundancy may be accomplished by a second power source or by a generator. All electrical transformers used underground shall be totally enclosed of the dry type with a NEMA 3R enclosure.
- E. Drainage Systems: The drainage system in underground work areas of the tunnel shall be designed and installed as to accommodate the maximum expected fire hose discharge and / or anticipated groundwater infiltration as described in the Geotechnical Baseline Report and all construction water used by the Contractor. All Contractor-supplied flows into the underground works shall be separately and continuously metered at the portal of the shaft. Tunnel sump pumps shall be explosion proof and shall continue to operate during an air monitor alarm condition.
- F. The exploratory tunnel water supply / fire hydrant will be located within 150 feet of the portal with a minimum 65 psi pressure and 500 gpm flowrate. This water supply will be available for both fire and construction water purposes. If a common supply is used within the tunnel for construction water and fire protection, provide a minimum of a 4" diameter header fitted with 2 ½" National Standard Thread (NST) fire hose valves every 275 feet and a fire department Siamese connection at the portal.

3.4 CLEANING

- A. Upon formal acceptance of the project, all temporary lighting, ventilation equipment and utility lines shall remain in place and be maintained and cleaned in accordance with the Special Note for Maintenance and Protection of Project Site and in working order and handed over to the Cabinet.

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSE OUT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Closeout procedures
- B. Final cleaning
- C. Starting of systems
- D. Demonstration and instructions
- E. Project record documents
- F. Project Construction Records
- G. Operation and maintenance data
- H. Details of Installed Utilities
- I. Manual for equipment and systems
- J. Spare parts and maintenance products

1.2 CLOSEOUT PROCEDURES

- A. Prior to Engineer's review and acceptance of the Work, submit written certification that all Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents.
- B. Provide submittals to Engineer required by authorities having jurisdiction.
 - a. Provide as-built drawings according to the Special Note for Submittal Procedures.
- C. All installed tunnel construction utilities shall become the property of the Cabinet. The Engineer and the Contractor shall conduct a joint inspection of the installed facilities. Prepare a listing of the equipment to be handed over and its condition at the time of ownership transfer. Sign the list as a record of its acceptance of the installed utilities. Other documentation and records required to be prepared by the Contractor that shall be handed over to the Engineer are as detailed in the following sections.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.

- B. Clean site; sweep paved areas, rake clean landscaped surfaces.
- C. Remove and properly dispose of waste and surplus materials, rubbish, or any additional items as directed by the Engineer from site.

1.4 PERFORMANCE OF INSTALLED SERVICE UTILITIES

- A. Demonstrate to the satisfaction of the Engineer that all installed temporary construction utilities in the Exploratory Tunnel are operational and in compliance with the applicable codes and standards.
- B. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of installed tunnel construction utilities to the Engineer at least one week before hand over of tunnel and installed utilities.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.
- C. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Change Orders and other modifications to the Contract
 - 5. Reviewed Shop Drawings, Equipment Data, and Samples
 - 6. Manufacturer's instruction for assembly, installation, and adjusting
- B. Ensure entries are complete and accurate, enabling future reference by Cabinet.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.

- F. Record Drawings: Legibly mark each Contract Drawing or Shop Drawing to record actual construction.
- G. Submit documents to Engineer with claim for final Application for Payment.
- H. All records shall also be submitted in electronic format for archive purposes. The records shall be arranged on the media to enable easy access and reference.

1.7 PROJECT CONSTRUCTION RECORDS

- A. All construction records that have been previously submitted to the Engineer in accordance with the relevant specification section shall be scanned and submitted on a referenced series of CD's or DVD's to the Engineer as an electronic archive. The documents shall be in a common readable format such as the Adobe Acrobat pdf. The records shall be arranged on the media to enable easy access and reference.
- B. Two copies of the electronic media shall be provided to the Engineer.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit data for all temporary tunnel construction facilities bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and as further detailed in Subsection 1.9. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria
 - b. List of equipment
 - c. Parts list for each component
 - d. Operating instructions
 - e. Maintenance instructions for equipment and systems
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and equipment data
 - b. Certificates
 - c. Photocopies of warranties

1.9 DETAILS OF INSTALLED UTILITIES

- A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- B. Include color coded wiring diagrams for all installed electrical equipment.
- C. Operating Procedures: Include start-up, and routine normal operating instructions and sequences, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Include servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Include control diagrams by controls manufacturer as installed.
- J. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- K. Additional Requirements: As specified in individual product specification sections.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections. Prepare inventory of all such items.
- B. Deliver any and all spare parts and extra products to the Cabinet at a specified location to be determined at the time of closeout.

1.11 MEASUREMENT AND PAYMENT

- A. No separate measurement for payments included for this Section. Any and all costs associated with this work shall be incidental to the bid item, Demobilization.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 02 32 13

GEOTECHNICAL INVESTIGATION IN EXPLORATORY TUNNEL

PART 1 GENERAL

1.1 SUMMARY

- A. Provide all necessary support facilities, including power, lighting, ventilation, dewatering and air quality monitoring, preparation Work, access and transportation for the equipment and Work necessary for undertaking geotechnical investigation in the Exploratory Tunnel.
- B. Undertake any remedial Work necessary to the installed initial support systems needed as a result of undertaking geotechnical investigation in the Exploratory Tunnel.
- C. The following Geotechnical Investigation Work will be undertaken in the Exploratory Tunnel and exploration bays:
1. Drilling core holes with core recovery
 2. Drilling exploration probe holes
 3. Water pressure testing of exploratory core and probe holes
 4. Grouting all drilled exploration core holes after completion
 5. Installing cyclical wetting and drying chamber of Waldron Shale and all subsequent testing and monitoring
 6. Conduct in-hole geophysical logging
 7. Installation and monitoring of geotechnical instruments defined in Section 31 09 13 - Instrumentation and Monitoring
 8. Tunnel Geologic Mapping
 9. Tunnel Photographic Survey
- D. For any activity that the Contractor employs a Specialty Contractor, supply all necessary utilities and assistance as well as undertaking any remedial Work to the installed initial support systems.
- E. Provide, maintain and remove all necessary utilities and assistance to the Engineer or any entity employed by the Engineer to undertake additional geotechnical investigation Work not included in this Specification. The Engineer will notify the Contractor at least 7 days before such Work starts of the scope of the utilities and assistance needed. Undertake any remedial Work, instructed by the Engineer, to the installed initial support systems that arise as a result of the Engineer's additional investigation Work.
- F. Related Sections:
- | | | |
|----|------------------|--|
| 1. | Special Note | For Submittal Procedures |
| 2. | Special Note | For Temporary Site Facilities and Controls |
| 3. | Section 01 35 00 | Safety Procedures for Tunnel Construction |
| 4. | Section 01 40 00 | Quality Requirements |
| 5. | Section 31 09 13 | Instrumentation and Monitoring |
| 6. | Section 31 71 26 | Probe Drilling and Grouting |

1.2 REFERENCES

- A. Abbreviations and Acronyms
 - 1. GBR: Geotechnical Baseline Report
 - 2. GDR: Geotechnical Data Report
- B. Definitions
 - 1. Specialty Contractor: A Contractor experienced in underground geotechnical investigation operations specified within this Section. This may be the Prime Contractor or a Sub-contractor who has demonstrated a suitable level of experience as noted in sub-section 1.3.
 - 2. Downhole Televiewer Survey: A down-hole method that uses an acoustic televiewer sonde to scan the image of the borehole wall to provide dip and dip direction.
 - 3. Tunnel Photographic Survey: A photographic survey of the tunnel in which digital photographs are analyzed by photogrammetric equipment to define the spatial distribution and orientation of rock mass features in the tunnel.
- C. Reference Standards
 - 1. American Society for Testing and Materials:
 - a. ASTM D2113 - Diamond Core Drilling for Site Investigations
 - b. ASTM D4220 - Preserving and Transporting Soil Samples
 - c. ASTM D420 - Standard Recommended Practice for investigating and Sampling Soil and Rock for Engineering Purposes
 - d. ASTM C150 - Specification for Portland Cement
 - e. ASTM D4428 - Standard Test Methods for Crosshole Seismic Testing
 - f. ASTM D6431-99 - Guide for Using the Direct Current Resistivity Method for Subsurface Investigation

1.3 QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements
- B. If a suitable level of experience in undertaking the geotechnical investigation Work included in this Section cannot be demonstrated, then employ a Specialty Contractor to undertake the Work.
- C. Suitable experience for a Contractor is defined as having undertaken at least 5 similar investigation operations in the previous 2 years. Demonstrate a record of successful completion of similar Work for the items listed in 1.1.C for the Contractor or Specialty Contractor performing the Work.
- D. The Contractor's lead supervisor shall be competent in geotechnical investigation techniques specified and shall submit evidence of at least five (5) years of experience on similar type projects. All of the Contractor's geotechnical investigation Work shall be under the direct field supervision of this supervisor. Assign a qualified specialist or foreman to each shift that geotechnical investigations Work is being conducted. Submit

evidence that each foreman has at least five (5) years of experience on similar type projects.

- E. The Contractor's technicians and drillers shall have documented experience with the specified exploration techniques.
- F. Changes to Contractor's personnel shall be accepted by the Engineer in writing.
- G. The Work shall be performed in accordance with ASTM D420, "Standard Recommended Practice for Investigating and Sampling Soil and Rock for Engineering Purposes" and all applicable ASTM Standards referenced therein. If there is a conflict between the ASTM Standards and these provisions, then these provisions shall govern.
- H. Locate boreholes within 2 feet of locations provided by the Engineer, and within one degree (1°) of the specified angle, and orientation (dip/dip direction of drilling).
- I. All elements that remain within the tunnel shall be non-metallic unless agreed otherwise with the Engineer.
- J. Information on Core Boxes:
 - 1. The outside top of a core box shall include the following information printed with a permanent marker:
 - a. County name
 - b. Project number
 - c. Item number
 - d. Core location (station, offset, and hole number, as applicable)
 - e. Surface elevation
 - f. Box number
 - 2. The inside lid shall contain the above information plus the total depth of the core.
 - 3. The end of the box shall be labeled with the following information:
 - a. County name
 - b. Project number
 - c. Core location (station, offset, and hole number as applicable)
- K. On Site Core Storage shall be present consisting of a racking system to store the core, tables to view the core, temperature control above 50 degrees F, and lighting to the approval to the Engineer. If a location is chosen off site, the facility shall consist of the same criteria listed above with the addition of restroom facilities and a service elevator if the storage is not at ground level to the approval of the Engineer.

1.4 SUBMITTALS

- A. Submittals shall conform to Special Note - Submittal Procedures.
- B. Submit the following to the Engineer for approval a minimum of 30 days prior to the site Work:
 - 1. Qualifications of the Contractor's site supervisor.
 - 2. A list of personnel including resumes and appropriate equipment that will be

used to perform the Work described herein prior to commencement of the investigation program. This list shall include the amount of experience in years that each proposed driller and technician has had with each of the techniques as specified herein.

3. Drilling equipment for rock probing and rock coring should be listed with respect to manufacturer and model.
4. Grouting equipment should be listed with respect to manufacturer and model.
5. Shop drawings and method statements for all Work specified herein.
6. Schedule and plan for all drilling procedures.
7. Proposed core box design.
8. Procedures for stopping or controlling the flow of water during drilling.
9. Design and installation procedures for grouting exploration probe holes and core holes under flow and pressure conditions as described in the GBR.
10. Methods of measuring water and grout pressure in the drilled holes.
11. Contingency plan defining actions to be taken in case grouting does not work as designed or is behind schedule.
12. Documented project history and record of experience in the specific geotechnical procedures that the Contractor intends to undertake itself.
13. For any Specialty Contractor employed by the Contractor the following shall be submitted in addition to the items included herein:
 - a. Documented project history and record of experience in the specific geotechnical procedures the Specialty Contractor is proposed for.
 - b. Qualifications and record of experience of the personnel to be employed by the Specialty Contractor

C. The following documentation as a minimum shall be submitted to the Engineer on completion of each drilling or grouting operation:

1. Borehole number, stationing, and coordinates, inclination angle
2. Name of driller and type of machine
3. Dates of setting up and removal
4. Weather on each day, including time of weather changes
5. Ground water presence and behavior in borehole
6. Date of each advance
7. Calculation of depth for each advance/run
8. Type and number of bit for each advance/run
9. Bit pressure and rotational speed
10. Times of start and finish of each advance/run (to nearest 5 sec), duration of any delays and number of times chuck was raised if applicable
11. Reasons for any core loss
12. Note of any core left behind in borehole
13. Note of any drops of rods due to cavities
14. Location of any exceptionally hard or exceptionally soft layers
15. Use of drill mud, type of drill mud
16. Estimated water or drilling fluid losses or inflow, with location of occurrences.
17. Results of Water Pressure Tests undertaken
18. Amount and size of casing inserted into borehole
19. Amount and size of casing drilled into borehole
20. Results of gas testing

- D. Submit a log for each hole grouted in a format accepted by the Engineer. Submit the record sheet including at least the following information, to the Engineer for information immediately upon completion of grouting:
1. Date and time of grouting operation
 2. Name of grouters
 3. Unique hole identification number
 4. Station of collar of hole
 5. Hole diameter and length of drilled hole
 6. Clock position of hole on perimeter of excavation
- E. For each grout stage the following information is required: depth of packer in hole, grout mix used as defined by water/cement ratio, additives used, pressure at point of injection at start and end of grouting operation, pressure at grout pump at start and end of grouting, weight and type of cement used, volume of grout pumped

1.5 SCHEDULE OF BID ITEMS

A. Measurement

1. Exploratory Probe Hole Drilling:
 - a. The Cabinet will measure the drilling of exploratory probe holes in the units listed in the Payment Subsection. The Cabinet will only measure exploratory probe holes instructed by the Engineer and will make a distinction for different depth intervals.
 - b. The Cabinet will measure grouting of the hole by the weight of cementitious material in the units listed in the Payment Subsection.
 - c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Drilling of exploratory probe holes, by rotary percussive means, in any direction and at any angle, to the pattern and lengths as directed by the Engineer.
 - 2) All Work to set up the equipment, drilling of holes at any angle to the depth required to achieve the specified coverage, dismantling and moving of equipment to other holes as required. All variations in the strata passed through; all Work, materials, and consumables; removal of flushing water; and monitoring equipment as defined in the Contract Documents.
2. Exploratory Core Drilling:
 - a. The Cabinet will measure the drilling of exploratory core holes in the units listed in the Payment Subsection and as detailed on the Drawings or instructed by the Engineer and will make a distinction for different depth intervals.
 - b. The Cabinet will measure grouting of the hole by the weight of cementitious material in the units listed in the Payment Subsection.
 - c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Lengths of cores that have been excessively fractured due to the drilling process.
 - 2) Drilling of core holes in any direction and at any angle.
 - 3) All Work to set up the equipment, drilling of holes at any angle

to the depth required to achieve the specified coverage, dismantling and moving of equipment to other holes as required. All variations in the strata passed through; all Work, materials, casings, core boxes and other consumables; removal of flushing water; and monitoring equipment as defined in the Contract Documents. Logging of the core and providing a driller's log for each core hole as described in this Section.

3. Water Pressure Testing:
 - a. The Cabinet will measure water pressure testing per the requirements of Section 31 71 26 within exploratory core holes by the number of properly executed tests, in the units listed in the Payment Subsection and as directed by the Engineer.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Tests that are not properly executed.
 - 2) All Work to set up the equipment, carry out staged water pressure tests to the satisfaction of the Engineer, dismantling and moving of equipment to other holes as required. All Work, materials, and consumables; removal of water; and monitoring equipment as defined in the Contract Documents.
4. Perforated Water Sprayer
 - a. The Cabinet will measure perforated water sprayers by the number of units installed in the units listed in the Payment Subsection and as shown on the Contract Drawings.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) All Work to install, calibrate, maintain and operate the equipment. All Work, materials, consumables, and removal of water.
5. Geotechnical Investigation Surveys
 - a. Geotechnical investigation surveys by Contractor or Specialty Contractor to be undertaken are:
 - 1) Downhole Televiewer Survey
 - 2) Tunnel Photographic Survey
 - b. The Cabinet will measure Geotechnical Investigation Surveys according to type, as detailed below in the units listed in the Payment Subsection.
 - c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply, including transportation to site and all handling; calibration; all Work, equipment and materials necessary to set up and read instruments in accordance with the Contract Documents including forming or drilling holes, recesses and surface preparation as applicable.
 - 2) Data acquisition, data processing, and production of graphs, data tables and interpretative reports and submission of copies to the Engineer.
 - 3) Readings submitted and subsequently found to be incorrect.
 - d. Access for In-tunnel Resistivity Survey

- 1) The Cabinet will measure this item in the units listed in the Payment Subsection for all phases of the Work.
- e. Tunnel Photographic Survey
 - 1) The Cabinet will measure the photographic survey in the units listed in the Payment Subsection.
 - 2) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Any length that has to be re-photographed or any length that does not have complete photographic coverage of at least one wall or the roof of the tunnel or exploration bay. All labor and equipment for the removal and replacement of mesh as required. The Tunnel
 - 3) Photographic Survey shall be performed, reported, and analyzed in three Phases:
 - a) Phase 1 - Portal rock cut and in tunnel SB 50+00 to SB 55+00
 - b) Phase 2 - SB 55+00 to SB 61+70
 - c) Phase 3 - SB 61+70 to SB 68+00.

B. Payment

1. The Cabinet will make payment for grouting of probe holes, core holes and cross-hole seismic survey holes under Section 31 71 26 - Probe Drilling and Grouting.
2. The Cabinet will make payment for the completed and accepted quantities under the following:

Code	Payment Item	Pay Unit
22238NN	Exploratory Probe Hole Drilling setup	Each
22239EN	Exploratory Probe Hole, >0 to 50 ft	Linear Foot
22240EN	Exploratory Probe Hole, >50 to 100 ft	Linear Foot
22241EN	Exploratory Probe Hole, >100 to 200 ft	Linear Foot
22242EN	Exploratory Probe Hole, >200 to 300 ft	Linear Foot
22243EN	Exploratory Probe Hole, >300 to 400 ft	Linear Foot
22244EN	Exploratory Probe Hole Grouting	Tons
22245EN	Exploratory Core Hole Drilling setup	Each
22246EN	Exploratory Core Hole Drilling, >20 to 50 ft	Linear Foot
22247EN	Exploratory Core Hole Drilling, >50 to 100 ft	Linear Foot
22248EN	Exploratory Core Hole Drilling, >100 to 200 ft	Linear Foot
22249EN	Exploratory Core Hole Drilling, >200 to 300 ft	Linear Foot
22250EN	Exploratory Core Hole Drilling, >300 to 400 ft	Linear Foot
22251EN	Exploratory Core Hole Grouting	Tons
22252NN	Water Pressure Test By Hour	Each
22253NN	Perforated Water Sprayer: supply, install, operate	Each
22254NN	Perforated Water Sprayer: maintain single installation monthly	Each
22255NN	Perforated Water Sprayer: base installation reading	Each
22258EN	Downhole Televiewer Survey	Linear Foot
22259NN	Access for Electrical Resistivity Survey	Lump Sum
22260EN	Geotechnical Investigation Hole Grouting	Tons

22261NN	Tunnel Photographic Survey: Phase 1	Lump Sum
22262NN	Tunnel Photographic Survey: Phase 2	Lump Sum
22263NN	Tunnel Photographic Survey: Phase 3	Lump Sum
22264NN	Reporting and Analysis, Tunnel Photographic: Phase 1	Lump Sum
22265EN	Reporting and Analysis, Tunnel Photographic: Phase 2	Lump Sum
22266NN	Reporting and Analysis, Tunnel Photographic: Phase 3	Lump Sum
22267NN	Reporting and Analysis, Final	Lump Sum

PART 2 PRODUCTS

2.1 DRILLING EQUIPMENT

- A. The drilling rigs and equipment shall be clean of all contaminating fluids, such as obvious leaks from hydraulic lines, couplings and fittings, in order to avoid contamination of the boring and Work area. The drilling machines shall be hydraulic-feed, rotary drill rigs in good working condition, and capable of satisfactorily securing cores of the required diameter at the maximum depth. Supplies for drilling shall include all casings, drill rods, bits, core barrels, pipe, pumps, water, tools, and any other equipment required to perform the required Work.
- B. Drilling equipment shall conform to Section 01 35 00 - Safety Procedures for Tunnel Construction and OSHA requirements in a potentially gassy tunnel.

2.2 GROUTING EQUIPMENT

- A. Conform to the general requirements of Section 31 71 26 - Probe Drilling and Grouting.

2.3 GROUT

- A. Cement shall conform to requirements of ASTM C150.
- B. Any Additives must be accepted by the Engineer.

PART 3 EXECUTION

3.1 DRILLING

- A. Undertake geotechnical investigation consisting of exploration core holes with recovery and groundwater cut-off system to ensure safe operation. The location of holes to be drilled are indicated on the Contract Drawings.

- B. The boreholes shall be drilled straight and be free of any obstructions. Provide final surveying of the collar elevations for probe holes and core holes after drilling. The tolerance shall be 0.5 degrees from centerline.
- C. Furnish all necessary fittings, appurtenances, and equipment for performing the Work. Submit plans, and detailed information about plant and equipment to the Engineer for approval prior to the commencement of the Work. Plant and equipment without prior approval by the Engineer shall not be used. The Engineer's prior approval does not relieve the Contractor of responsibility for satisfactory performance of the Work in the field. Unsatisfactory plant and equipment shall be removed from the site of the Work when so directed by the Engineer and replaced with satisfactory plant and equipment at no additional cost.

3.2 CORING

- A. Coring shall be undertaken with HQ size double-tube core barrel and diamond bits, capable of producing cores with minimum diameter of 2-1/2 inches. Continuous coring shall be performed in accordance with ASTM D2113, to a length as directed by the Engineer.
- B. The core bit shall be started in the hole and drilled for a minimum depth of five feet. The drill shall then be withdrawn and the core removed from the barrel, labeled and stored as hereinafter specified. The borehole isolation set up allowing for drilling and grouting under high water head as stated in this Section above shall be installed. Drilling may be continued in runs not exceeding five feet until the total length required by the Engineer has been reached. If the core bit should become blocked by a piece of broken core, the barrel shall be retrieved and cleared before continuing the drilling. If the barrel cannot be advanced beyond a previous run, provide adequate means to advance the core barrel to the required sampling depth.
- C. Exercise due care to obtain a satisfactory core from all material of a character that would ordinarily produce satisfactory rock cores under the operation of a standard type of core drill.
- D. It is important that the percentage of recovery of the cores shall be as large as possible and regulate the speed of the drill and remove the core frequently to obtain a reasonable amount of core recovery.
- E. The use of foam, bentonite or mud slurries as accepted by the Engineer will be allowed to aid drilling.
- F. All casings shall be removed upon completion of the Work and it shall remain the property of the Contractor.
- G. All drillers' logs shall be submitted to the Engineer.
- H. Survey all coreholes to determine the straight line deviation.
- I. Orientation of Core:

1. Core samples shall be placed in the boxes, beginning with the upper left corner compartment and working toward the right. When this compartment is filled, additional samples are placed in the next upper left hand compartment, etc.
2. Each core run shall be separated by a 1-inch wooden block showing depth.
3. Cores from different holes shall not be placed in the same core box.
4. The beginning and ending depths of the core sample in each box shall be marked on the edge of the box.

J. Drill log: One typed log is required for each hole. The log will be based on the field log completed by the driller.

3.3 GROUNDWATER OBSERVATIONS

A. Observe groundwater conditions in all borings during drilling. Any and all water conditions, including gain or loss of drilling fluids and the presence of gas or artesian flows shall be noted. This Work is considered incidental to the drilling operations and no separate payment will be made.

3.4 WATER PRESSURE TESTING

A. Water pressure testing shall be conducted as per Specification Section 31 71 26 - Probe Drilling and Grouting.

3.5 HANDLING AND PRESERVING CORE SAMPLES

A. At the completion of each boring, recovered samples shall be delivered to the Geotechnical Branch, Division of Structural Design, Frankfort, Kentucky, unless otherwise directed.

B. The costs of storage and transporting recovered samples are considered incidental to the sampling operations, and no separate payment will be made.

3.6 EXPLORATORY PROBE DRILLING

A. Exploratory probe drilling shall be conducted as per Specification Section 31 71 26 - Probe Drilling and Grouting and as shown on Contract Drawing GI-001.

3.7 PERFORATED WATER SPRAYER OF WALDRON SHALE

A. The Perforated Water Sprayer or pipe mounted to a rigid frame shall consist of a cyclical wetting and drying chamber. The frame shall be anchored to rock and restricted to movements less than 1/10 inch. The rigid frame position shall be checked by survey to a stable, remote benchmark prior to performing each cyclical wetting and drying test. Cyclical wetting and drying tests on the Waldron Shale shall consist of spraying water through the perforated sprayer for a period of up to 12 hours followed by a period of up to 24 hours to allow the rock surface to dry or to a cycle duration as directed by the Engineer.

- B. Measurements shall be taken by the Engineer from the rigid frame to the rock profile at least two times during a wetting and drying cycle. The profile measurements shall consist of at a minimum of 10 horizontal distances measured over a vertical elevation of 5 feet to an accuracy of 1/10 inch.

3.8 ABANDONED HOLES AND OBSTRUCTIONS

- A. Should any of the following conditions occur the Engineer will instruct the Contractor to undertake an additional coring or probe hole at no additional cost to the Cabinet:
 - 1. Casing or apparatus removed from a boring
 - 2. Boring abandoned without permission of the Engineer
 - 3. Boring for any reason not carried to the depth required by the Engineer
 - 4. Failure to keep complete records of ground conditions encountered
 - 5. Failure to furnish to the Engineer the required sample and cores
- B. All abandoned borings shall be fully grouted immediately after completion subject to approval by the Engineer at no additional cost to the Cabinet.
- C. Abandonment of borings shall be documented and the information provided to the Engineer. Documentation shall include the depth and number of the boring, the date the boring was completed, and other pertinent data. Under no circumstances shall casing and/or other metal elements be left in the boring.

3.9 GROUTING OF PROBE AND CORE HOLES

- A. The casing and all other metallic elements shall be pulled and the site cleaned up before demobilizing from the location of the hole.
- B. Fully grout all core and probe holes to the collar.

3.10 CONTRACTOR'S DAILY REPORT

- A. Contractor's Daily Report shall be completed by the Contractor's supervisor and agreed to by the Engineer upon completion of each day's Work. The supervisor for each drill rig will come to agreement with the Engineer on quantities of Work performed each day. A quantity sheet shall be supplied by the Engineer and will be signed by the supervisor and Engineer upon the completion of each day's Work. The Contractor's Daily Report shall be the basis of payment for the drilling quantities.

3.11 GEOLOGIC MAPPING

- A. Provide the Engineer with free access to the heading, roof, and sidewalls of the tunnel to perform mapping of the geology as considered necessary. Clean excavated surfaces of the tunnel for mapping purposes as required by the Engineer. Provide incidental labor assistance as required. The Contractor and Engineer shall coordinate work and mapping in the field.
- B. Have the Engineer present while performing mapping in the field.

- C. Provide a copy of each day's mapping to the Engineer within one (1) business day.

3.12 GEOPHYSICAL LOGGING: DOWNHOLE TELEVIEWER SURVEY

- A. Borehole acoustic televiewer sonde shall be used in selected boreholes to provide dip and dip direction of discontinuities in the borehole wall.
- B. Televiewer system consists of a probe, a wire line winch and a data acquisition computer. The probe (1 5/8 inches in diameter and 9 feet long) will be inserted to the end of the borehole and will scan the image of the borehole wall as it travels to the start of the borehole.
- C. Scanned data will be processed by software to determine true depths, dip angles and dip directions of discontinuity planes. Geophysical logging will consist of a Gamma Probe for lithological mapping. .
- D. The following covers the extent of the Work to be performed:
 - 1. Geophysical logging using downhole televiewer shall be performed by the Contractor or Specialty Contractor at locations within coreholes as designated by the Engineer.
 - 2. Provide a fully equipped drilling rig capable of lowering and lifting the geophysical logging tools into and out from the test holes.
 - 3. The Contractor or Specialty Contractor shall provide all supplies which shall include, but not be limited to all cable reels, power cords, generator and/or transformer for power supply, data acquisition system to record and process data, printer, standby fuels, and tools necessary for maintaining uninterrupted logging for each boring to be logged.
 - 4. As a minimum, the data and results from the logging by the Contractor or Specialty Contractor shall include logging data and interpretation, descriptions of the data obtained, the procedure used to reduce the data, and the interpretation and discussion of the results. Appropriate tables and figures showing the logging equipment, borehole locations with relation to the tunnel, geometry of the boreholes, borehole logs showing discontinuity orientation, borehole images, and clay content as a function of depth.

3.13 TUNNEL PHOTOGRAPHIC SURVEY

- A. The tunnel photographic survey is to provide a photographic record of the ground conditions encountered during construction of the Exploratory Tunnel and exploration bays. The photographic survey is to be undertaken by the Contractor or Specialty Contractor or as stated below in coordination with surveying techniques to provide a spatially arranged photographic record. The data shall be obtained by either digital-optical or laser photogrammetric equipment.
- B. All excavation surfaces shall be photographed. Take steps to ensure that the equipment is readily available at site for the use of the Contractor's survey crew as necessary. Special provisions shall be made for those support types, which require shotcrete application on a round, by round basis. In such ground types where shotcrete applications is required, ensure that the right hand side wall as a minimum remains available for photography and

inspection prior to installation of any shotcrete. In addition to this requirement, scanning of the tunnel is to be undertaken for both walls and the roof of the tunnel where shotcrete has not been immediately placed. If required, mesh is to be temporarily removed over a length sufficient to allow only one photographic scan to be undertaken at a time to ensure the safety of the tunnel. Mesh is to be replaced before removing subsequent panels.

C. Qualification of personnel

1. Operators of photographic survey systems shall either:
 - Have at least 2 years of experience in tunnel scanning
 - Be a qualified Land Surveyor with 2 years underground survey experience and trained on site by operators with at least 2 years experience in tunnel scanning

D. Hardware

1. Positioning and orientation of scanner must be better than $\pm 1/12$ inch of standard deviation
2. All scans must be oriented in the project coordinate system
3. Accuracy of scans must be better than $\pm 1/2$ inch
4. Tunnel scanner must provide a black and white picture of the scanned surface with a resolution of better than $1/4 \times 1/4$ inch. The grey scale shall be 256 (8) bit
5. Evaluation of acquisition data must be possible on site and the results provided to the Engineer

E. Software

1. Software must be able to calculate a 3-D model of the tunnel with a pixel grid of $1/2 \times 1/2$ inch or better and manage the data obtained from the tunnel scanning hardware
2. Software must manage all coordinates in absolute x, y, z system
3. The Ortho picture plot shall indicate scale, stationing of tunnel, arc length, center line of tunnel, type of view from tunnel or from rock

- F. Results shall be available as black and white prints using 1:50 scale on 11 x 17 photo paper and in PDF on CDs as defined in the Special Note for Submittal Procedures.

3.14 ACCESS FOR IN-TUNNEL ELECTRICAL RESISTIVITY SURVEY

- A. The Engineer will provide written notification to the Contractor no less than ten (10) working days prior to the survey being performed and access in the exploratory tunnel being needed. Upon notification by the Engineer provide access to the exploratory tunnel for the electrical resistivity survey.
- B. Provide a safe working environment for access to site and utilities, including but not limited to: lighting; drainage; power; and ventilation for the Engineer to perform the electrical resistivity survey. The survey will be required in phases as shown on the contract drawing GP-001.
- C. Make no claim or request additional compensation for delay or impact to schedule for this work.

END OF SECTION

SECTION 03 37 13

SHOTCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish and install shotcrete as part of the initial support for the tunnel as shown on the drawings and described in these Specifications.
- B. Provide shotcrete as required by the Contractor's design and support sequence for any excavations constructed for the Contractor's convenience.
- C. Provide all Labor, materials, equipment, testing, required for production and application of un-reinforced or reinforced shotcrete.
- D. Apply shotcrete by the wet-mix process only.
- E. Related Sections:
 - 1. Special Note For Submittal Procedures
 - 2. Section 01 32 23 Tunnel Surveying
 - 3. Section 31 71 16.01 Tunnel Excavation by Drill and Blast
 - 4. Section 31 72 13 Rock Reinforcement and Support

1.2 REFERENCES

- A. Definitions
 - 1. Shotcrete: is a Portland cement concrete mix, containing admixtures to provide quick set high early strength and satisfactory adhesion, which is conveyed through a hose and pneumatically projected at high velocity onto a surface. It may be un-reinforced or reinforced with either welded wire fabric or fibers.
 - 2. Wet Mix Process: is shotcrete in which all of the ingredients except the accelerator are mixed before introduction into the delivery hose. Accelerator is added to the shotcrete mixture at the nozzle in such a way that the quantity can be properly regulated.
 - 3. Rebound: is shotcrete constituents that fail to adhere to the surface to which the shotcrete is being applied.
 - 4. Corrective Shotcrete: is shotcrete used to replace defective shotcrete.
 - 5. Defective Shotcrete: is shotcrete that does not meet strength or toughness requirements or which lacks uniformity, exhibits segregation, honeycombing, or lamination, shows significant cracking, fails to meet the watertightness criteria, contains any dry patches, or sand pockets, is hollow or does not meet the specified requirements.

6. Fiber Shotcrete: is the same as “shotcrete” except that in addition to the shotcrete mix, fibers are incorporated into the mix to meet specified flexural strength and toughness requirements. As shown on the Contract Drawings, steel fibers are used at the portal rock face and non-steel fibers within the Exploratory Tunnel.
7. Supplemental Support: Supplemental Support for shotcrete is additional thickness of shotcrete support placed at the direction of the Engineer either in addition to the dimension of shotcrete shown on the Contract Drawings or on excavated surfaces that are presently shown not to require shotcrete on the Contract Drawings.

B. Reference Standards

1. American Concrete Institute:
 - a. ACI 221.1 – Report on Alkali-Aggregate Reactivity
 - b. ACI 301 – Specifications for Structural Concrete
 - c. ACI 506.2 – Specification for Materials, Proportioning and Application of Shotcrete.
 - d. ACI 506.3 – Guide to Certification of Shotcrete Nozzlemen.
 - e. ACI 506.4 – Guide for Evaluation of Shotcrete.
2. American Society for Testing and Materials:
 - a. ASTM A185 – Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - b. ASTM A820 – Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
 - c. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - d. ASTM C33 – Standard Specification for Concrete Aggregates.
 - e. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - f. ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - g. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
 - h. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates
 - i. ASTM C150 – Standard Specification for Portland Cement.
 - j. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
 - k. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
 - l. ASTM C566 – Total Moisture Content of Aggregate by Drying
 - m. ASTM C1140 – Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels
 - n. ASTM C1141 – Standard Specification for Admixtures for Shotcrete.
 - o. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete and Shotcrete.

- p. ASTM C1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures
- q. ASTM C1436 – Standard Specification for Materials for Shotcrete

1.3 SUBMITTALS

- A. Submittals shall conform to Special Note For Submittal Procedures.
- B. Submittals shall be made in accordance with the requirements of Special Note For Submittal Procedures and the Contract. In addition the following specific information shall be provided to the Engineer for acceptance at least 30 days prior to the actual application of shotcrete to any surface forming a part of the Work under this Contract, and whenever the Contractor proposes a change to the mix or source of materials:
 - 1. The proposed mix shall be submitted with a satisfactory historical record of strengths per these Specifications.
 - 2. Details of the cement, aggregate and pozzolan materials sources and properties together with laboratory test reports of the proposed mix and compatibility test results.
 - 3. Furnish details of the independent testing laboratory for the testing of shotcrete to the Engineer prior to the commencement of trials. Provide a complete report of test results to the Engineer at the conclusion of laboratory testing.
 - 4. Submit proposed equipment, methods of storage, transportation, batching and mixing of materials for test and production shotcrete
 - 5. Submit qualifications and experience of Nozzlemen. Nozzlemen shall have had previous experience in the application of coarse aggregate shotcrete on at least two projects of comparable nature, or shall Work under the immediate supervision of a foreman or instructor with at least five years of such experience. Only nozzlemen certified in accordance with ACI 506.3 shall be employed for this Work. Each crew shall demonstrate, to the satisfaction of the Engineer, acceptable proficiency in the application of shotcrete to vertical and horizontal test panels before beginning production Work
 - 6. Daily progress reports to the Engineer documenting shotcrete operations. The reports shall contain the following information, as a minimum, and be in a format agreed with the Engineer:
 - a. The areas where shotcrete was placed each day by each nozzleman. Areas shall be indicated by station, elevation, and/or sketch, indicating volume placed and the amount and type of welded wire fabric or fibers used. Identify nozzleman and foreman on each report.
 - b. The date and time each area was placed
 - c. Maximum and minimum air temperature
 - d. The curing and protective measures employed
 - e. Estimate of the percentage of rebound
 - f. Description of any special conditions or problems encountered

1.4 QUALITY ASSURANCE

- A. Section 01 40 00 - Quality Requirements
- B. Prequalification of Nozzlemen and Mixes

1. Each nozzleman shall demonstrate an ability to produce the required shotcrete by shooting test panels prior to any on-site Work. The test panels shall be shot using the Contractor's proposed mix and equipment and shall contain the same cement, aggregate, admixture and water to be used in the Work. Welded wire fabric may be included in certain panels if required by the Engineer. The Contractor may consider shooting the test panels of other mix designs, if accepted by the Engineer, so that the 28-day delay for test results will not affect anticipated startup of shotcrete operations on site. However, panels shall be obtained for each nozzleman for each mix actually used on the Work.
2. Each nozzleman shall shoot vertically upward on a horizontal panel and horizontally on a vertical panel to simulate field conditions. Each test panel shall be shot into a box 36-inch by 36-inch and 3-inch deep constructed of wood at least 3/4-inch thick. Boxes of other sizes and materials may be used if accepted by the Engineer. Boxes shall be supported during shotcreting to prevent vibration. When shooting vertical panels, the box shall have only three sides, with the bottom side open to permit the escape of rebound. After the initial set has occurred, the shotcrete shall be scored along the bottom of a vertical panel to facilitate later removal.
3. Each qualification panel shall be allowed to cure in place for 24 hours. Panels shall be protected from sun and wind and shall be cured with water from the time of completion until they are delivered by the Contractor to the testing laboratory in a wet condition. Heating of the panels above 90 F during this time shall not be allowed. Transportation methods shall protect the panels from freezing and from flexure, impact, or loading which might cause damage.
4. Each panel shall be identified, as a minimum, by the Contractor's name, construction job number, the date and time shot, the name of the nozzleman, the cement-aggregate ratio of the mix, additives, if any, and whether the panel was horizontal or vertical when shot. Panels, which contain reinforcing, shall be so marked.
5. Panels shall be wet cured in the laboratory at 73F. No test specimen shall be taken closer than 4 inches to an edge of panel. After test specimens have been cut, the specified cure shall be resumed until they are tested.
6. Compressive strength test specimens taken from the panels shall be 3-inch cores. Except for cores taken for the 24-hours tests, test specimens shall be soaked in limewater a minimum of 40 hours, prior to testing. Specimens shall be cored, capped, and tested in accordance with ASTM C 1140.
7. Nine compressive strength test specimens shall be taken from each panel in direction of spraying delivery. Three compressive tests each shall be performed at 24 hours, at 72 hours and 28 days.
8. In addition to shooting test panels, each nozzleman shall demonstrate ability to apply shotcrete under actual field conditions by shooting a test section in the tunnel or another suitable location as agreed with the Engineer. The mix and equipment used shall be the same as that proposed by the Contractor for the actual Work. The Engineer may require that rebound be collected to evaluate the quality of the placement and resultant in-place mix. Test sections shall be allowed to cure in place, under the same conditions proposed for use in the actual Work.

9. The mix design and nozzlemen proposed shall be considered satisfactory for use on the Work if the following criteria are met:
 - a. All cored or broken surfaces are dense and free from laminations or sand pockets.
 - b. All reinforcing is completely covered with shotcrete, and the shotcrete surround the reinforcing is dense and free from voids or honeycomb (applies only to panels or test sections containing reinforcing).
 - c. The average compressive strength of the cores from each panel is at least equal to the strength criteria specified within this Section.
 - d. Test sections do not show excessive sloughing or rebound of material during placement.
 - e. In-place coring and sound of test sections show proper bonding of shotcrete to rock.
 - f. The average compressive strength of three cores from each test section in the tunnel meets or exceeds 85 percent of the respective strength criteria specified in this Section.

1.5 MOCKUP

- A. Laboratory and Field Testing
 1. All costs for developing shotcrete mixes including field trials and laboratory tests, prior to approval of mixes by the Engineer, shall be at the expense of the Contractor, and shall be considered incidental to Work under this Section.
 2. The Engineer may require additional test panels and/or to core production shotcrete when shotcrete strengths method of application or quality are in question.

1.6 SCHEDULE OF BID ITEMS

- A. Measurement
 1. The Cabinet will measure the supply and installation of shotcrete support and all necessary incidentals.
 2. Portal Face:
 - a. The Cabinet will measure the supply and installation of the portal face support in the surface excavation in the units listed in the Payment Subsection and as shown on the Drawings.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) All activities as noted in the Subsections below irrespective of the rock type encountered. Additional geotechnical investigation, testing, logging, mapping, slope re-design, and monitoring as may be considered necessary to ensure that the support installed will provide a stable and safe working environment.
 - 2) Supply, delivery and handling on site of all materials and equipment required to install the tunnel portal rock support.

- c. Fiber shotcrete:
 - 1) The Cabinet will measure the supply and installation of shotcrete in the units listed in the Payment Subsection and as defined on the Drawings, or additional shotcrete as directed by the Engineer.
 - 2) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Preparation of surfaces and provision and application of shotcrete, all materials, cleaning of rebound, thickness control measures, drilling of holes for checking thickness, all mix design and routine testing
 - d. Weep hole in fiber shotcrete:
 - 1) The Cabinet will measure the supply and installation of weep hole detail to provide pressure relief of fiber shotcrete, in the units listed in the Payment Subsection and as shown on the Drawings or as directed by the Engineer.
 - 2) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Drilling of hole of defined diameter, length and orientation, cleaning of hole, and placement and grout attachment of the appropriate slotted drainage pipe.
3. Exploratory Tunnel:
- a. Shotcrete:
 - 1) The Cabinet will measure the net area in the units listed in the Payment Subsection, successfully applied to the excavated surface based on an area measured on the theoretical excavated cross section (designated on drawings defined by the pay lines).
 - 2) Where directed by the Engineer that the full specified thickness be built up as separate layers, payment will be made at the amounts bid for the separate individual layers.
 - 3) A distinction will be made between shotcrete placed as initial support and that placed as balance, supplemental or upgrading of support.
 - 4) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Preparation of surfaces and provision and application of shotcrete, all materials, cleaning of rebound, thickness control measures, drilling of holes for checking thickness, all mix design and routine testing.

B. Payment

- 1. The Cabinet will make payment for the completed and accepted quantities under the following:

Code	Payment Item	Pay Unit
Portal Face:		
22268EN	Fiber Shotcrete 3-inch	Square Foot
22269NN	Weep Hole in Fiber Shotcrete	Each
Exploratory Tunnel:		
22270EN	Exploratory Tunnel: Mandatory Shotcrete - Type P	Square Foot
22271EN	Exploratory Tunnel: Mandatory Shotcrete - Type IV	Square Foot
22272EN	Exploratory Tunnel: Initial Support - Type II, III, & Karstic Voids	Square Foot
22273EN	Exploratory Tunnel: Initial Support - Type EBC	Square Foot
22274EN	Supplemental Support - Mandatory Shotcrete Type I, II, III, and Karstic Voids	Square Foot
22275EN	Supplemental Support - Mandatory Shotcrete Type EBC	Square Foot
22276EN	Supplemental Support - Fiber shotcrete (polypropylene)	Cubic Yard

PART 2 PRODUCTS

2.1 SHOTCRETE MATERIALS

A. General

1. Shotcreting shall conform to all requirements of ACI 506.2 except as herein modified.
2. Shotcrete shall be applied Wet-Mix method only.
3. Uniformity of Materials: The same source of cement, aggregate, admixtures and water used in accepted test mixes and field trials shall be used for production Work. Minor adjustments will be permitted subject to prior written acceptance by the Engineer. Specified strengths and toughness requirements shall be maintained.

B. Cement

1. Cement shall conform to ASTM C150, Type I

C. Aggregates

1. The gradation of the combined coarse and fine aggregate mixture shall conform to the following limits:

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing (By Weight) Gradation</u>
1/2 inch	100
3/8 inch	90-100
No. 4	70-85
No. 8	50-70
No. 16	35-55

No. 30	20-35
No. 50	8-20
No. 100	2-10
No. 200	<2

2. Aggregate shall be uniformly well graded and shall not exhibit extremes of variation in accordance with ASTM C33
3. Water shall be potable
4. Calcareous sand shall not be used
5. Specific gravity shall be a minimum of 2.55
6. Both fine and coarse aggregates shall be tested for potential aggregate cement reactivity
7. The level of soluble sulfates and chlorides in the aggregate shall not exceed the values stated in ACI 318M for reinforced shotcrete
8. The gradation and maximum size of the aggregate may be varied on the basis of actual materials available and experience with placing on the project, subject to acceptance of the Engineer.
9. Recycled rebound material shall not be used

D. Admixtures

1. No admixtures, other cements, limes, antifreeze compounds, accelerating mixtures, or soluble compounds shall be used in the shotcrete unless accepted by the Engineer. Approval for the use of accelerators will be based on test results from test panels and cement-additive compatibility tests performed by the Contractor. Results of compatibility tests shall be submitted to the Engineer prior to shooting test panels.
2. Admixtures shall be free of chlorides such that the percentage of chlorides shall not exceed 0.1% by weight.
3. Storage conditions and usage of admixtures shall comply with the manufacturer's recommendations.
4. Only liquid accelerators shall be used. Only the minimum quantity of accelerator necessary shall be permitted in normal shotcrete spraying operations. The quantity shall be determined by Field Trials, subject to maximum dosage of 6% by weight of cementitious material.
5. An accepted liquid accelerating mixture shall be used in accordance with ASTM C1116 as follows:
 - a. Time of initial set: 3 minutes maximum
 - b. Time for final set: 12 minutes maximum
6. Accelerators delivered to the site shall be tested at least once every two months for their reaction with the cement used with particular reference to the setting behavior and strength decrease after 28 days. The stability of accelerators during storage shall be visually inspected at similar intervals. Storage times and working temperature ranges shall be in accordance with the manufacturer's recommendations. The manufacturer's safety instructions shall be observed.
7. Admixtures shall conform to the requirements of ASTM C1141, with the following additional requirements:
 - a. Admixtures shall not contain the following:

- 1) Materials that may cause other detrimental effects such as cracking or spalling
- 2) Materials corrosive to steel

E. Wire Fabric

1. Where welded wire fabric is used for reinforcing the shotcrete this shall conform to ASTM A185 and be sized as shown on the Contract Drawings.

F. Silica Fume

1. Silica Fume shall comply with ASTM C1240 and with the following requirements:
 - a. Dry powder
 - b. The silica content shall be not less than 85% and the particle size shall be between 0.1 and 0.2 microns.
 - c. The Silica Fume shall not contain more than 0.2% silica metal by mass or any deleterious materials such as quartz, rust and/or cellulose fibers.
 - d. Fineness: specific surface area shall not be less than 73236 ft²/pound.
 - e. The carbon content shall not exceed 2% and the total alkali content as Sodium Oxide (Na₂O) equivalent shall not exceed 2%.
 - f. The activity index shall be greater than 95% after 28 days.
 - g. The moisture content shall not be greater than 3% and SO₃ (water-soluble) shall be less than 1%.
2. Silica Fume/Water slurry shall comply with the following requirements:
 - a. pH shall be 5.5 ± 1.0.
 - b. The viscosity shall be 20 seconds with a 0.157 inch-viscosity cup and the relative density shall be between 1.3 and 1.4.
 - c. Testing to establish compliance with a) and b) above shall be carried out on a periodic basis.
 - d. Storage and handling: Silica Fume/water slurry shall be regularly agitated by circulation pumps prior to use.
3. The compatibility of Silica Fume and admixtures shall be established by carrying out the appropriate accelerated testing procedures.
4. The optimum content of Silica Fume shall be determined during site trials.

G. Fibers

1. Steel Fibers (Portal Walls)
 - a. Steel fibers to be used in Fiber Shotcrete installed on the portal face shall be between 1-1/4 to 1-1/2 inches in length. Steel fibers shall conform to the requirements of ASTM A820 and shall have an aspect ratio of between 40 and 85 with bent or deformed ends.
 - b. The optimum fiber content shall be established during the trial mix design and shall take into consideration minimum fiber rebound, good fracture distribution, flexural tensile strength, toughness, crack width limitations and optimum bonding effect in accordance with the Specification.
 - c. Water soluble glue or other additives used to collate steel fibers shall be compatible with other shotcrete components.
 - d. Fibers shall be stored in dry sealed containers until ready for use and shall be free from corrosion, oil, grease, chlorides and deleterious

materials which may reduce the efficiency of mixing or spray process, or which may reduce the bond between the fibers and the shotcrete.

2. Non-Steel Fibers
 - a. Non-steel fibers shall be polypropylene/polyethylene high performance macro-monofilament fiber and manufactured specifically for the reinforcement of concrete. Fibers shall be added at the batch plant and mixed for sufficient time, as recommended by the manufacturer, to ensure uniform distribution of the fibers through the shotcrete mix. The minimum fiber content of such fiber- reinforced shotcrete shall be according to the manufacturer's recommendations.

H. Mix Design Requirements

1. Compressive strength - The design mix for plain and reinforced shall develop specified compressive strength progressively as follows:
 - a. Age of Specimen and required specified compressive strength
 - 1) 24 hours - 1,000 psi
 - 2) 72 hours - 3,500 psi
 - 3) 28 days - 5,000 psi
2. Admixtures shall not be in excess of 3% of the cement weight, except for Pozzolanic or Silica Fume admixtures.

2.2 EQUIPMENT

A. Wet Mix Process

1. Placing equipment for Wet Mix process shall be capable of handling and applying shotcrete containing the specified maximum size aggregate and accelerating admixture.
2. The water supply system shall be capable of supplying the delivery machine and hose at pressures and volumes recommended by the manufacturer of the machine.
3. The air supply system shall be capable of supplying the delivery machine and hose with air at the pressures and volumes recommended by the manufacturer of the machine. No air supply system shall be used that delivers air contaminated by oil or that is incapable of maintaining constant pressure.
4. The delivery machine shall be capable of introducing materials to the delivery hose at a uniform rate, with ejection from the nozzle at velocities that result in adherence of material to the treated surface with a minimum Rebound and maximum adherence and density.
5. The placing equipment shall be arranged so that the nozzleman may use air and water in any combination to prepare raw surfaces for shotcreting or to clean completed Work.
6. The equipment shall be maintained in clean and proper operating condition satisfactory to the Engineer.
7. A sufficient number and type of spare parts shall be stored at the site in order to minimize interruptions of the shotcreting operations due to equipment breakdown.
8. Equipment shall be furnished to allow application of shotcrete to surfaces with the nozzle at the specified distances from the Work.

9. Liquid accelerators shall be metered uniformly into the nozzle with an electrically powered chemical metering pump in synchronization with the shotcrete output.

PART 3 EXECUTION

3.1 PREPARATION

- A. All rock surfaces shall be scaled to remove loose rock prior to shotcrete operation.
- B. Rock surfaces upon which shotcrete is to be placed shall be cleaned with air and/or water and shall be free from oil, standing or running water, mud, rebound, overspray, or other objectionable coatings, loose material or debris that will prevent bonding of shotcrete to the rock.
- C. All rebound and other loose material on surfaces already shotcreted shall be raked or blown off and the surface cleaned of all loose material and other debris prior to start of shotcrete operations.
- D. All rebound and waste shotcrete shall be removed from the tunnels and shall be disposed of in the designated disposal areas. Rebound shall not be reclaimed for use in shotcrete
- E. Certain rock conditions may require special preparations. Joints or seams having loose rock fragments or soft or swelling fillings shall be excavated and grouted or packed as agreed with the Engineer. Joints or seams having clay or slick surfaces shall be cleaned and roughened to promote bonding of shotcrete.
- F. Where water flows from the rock against which shotcrete is to be placed, the water shall be excluded from the area by caulking, cut-off grouting, installing drain pipes, panning, backdrains, underdrains, sandbagging, or diverted by pipes or other means agreed by the Engineer, so that the shotcrete will be unaffected by action of the water and hydrostatic pressure will not develop behind the shotcrete lining. Control water as needed to ensure adequate bond between the shotcrete and the ground.
- G. Where welded wire fabric is required, prior to placement of shotcrete, inspect the previously installed welded wire fabric. In areas where the welded wire fabric has been damaged due to excavation or other construction procedures, the damaged materials shall be removed and replaced at no additional cost to the Cabinet. Any loose pieces of rock behind welded wire fabric, which might interfere with the proper placement of shotcrete shall be removed. Welded wire fabric, which has deteriorated shall be repaired and/or replaced as required.

3.2 PROPORTIONING AND MIXING SHOTCRETE

- A. Design compressive strength of in-place shotcrete to meet criteria specified herein.
- B. Select the actual mix to be used to satisfy strength, performance and quality requirements and submit to the Engineer for review prior to use on the Work.

- C. The mix shall contain a minimum requirement of Portland cement of 640 lbs/yd³, fly ash 67 lbs/yd³, and silica fume 50 lbs/yd³. The aggregate maximum size shall be ¼-inch to ¾-inch. Aggregate shall be well graded and no fraction shall exceed 30%. The water-cement ratio shall not be more than 0.45. For steel fiber reinforcement a minimum of 70 lbs/yd³ should be added to the mix for use on the portal walls.
- D. The mix shall not be sprayed if transportation and application cannot be completed within 90 minutes after initial blending. The mix shall be disposed of at a site accepted by the Engineer.
- E. The mixer shall be clean and dry before introducing the ingredients.

3.3 PLACING SHOTCRETE

- A. The amount of water used in each mix shall in no case be greater than that used for the same mix shot on a vertical surface. The Engineer may at any time require a demonstration that an excess of water is not being used, by shooting a test piece on a vertical surface.
- B. The shotcrete shall be delivered to the substrate in an uninterrupted flow and be free from pulsation effects.
- C. Shotcrete shall not be placed when the ambient temperature is less than 40 F, except when measures accepted by the Engineer are taken to maintain the temperature of the rock surface at or above 40 F for a minimum period of 48 hours prior to shotcreting.
- D. When relative humidity is less than 85%, and for all open-air applications, maintain the shotcrete surfaces in a moist condition by spraying water for the duration of the curing period
- E. The nozzle shall be held at such distance and position that the stream of flowing material shall impinge as nearly as possible at right angles to the surfaces being covered at a maximum distance of 3-1/2 feet and so that a minimum of rebound will fall on surfaces yet to be shot.
- F. Shotcrete over the rock surface shall have a minimum thickness as shown on the Contract Drawings.
- G. Shotcrete shall be applied in such coats as may be necessary to build up the required thickness, but succeeding coats of shotcrete shall be applied before the initial set of underlying coats so that the entire thickness of shotcrete at any point will have a monolithic, homogeneous structure. In no case shall any single application of shotcrete exceed a thickness of 3 inches.
- H. Measurement pins acceptable to the Engineer shall be placed on a minimum three-foot by three-foot pattern, or as agreed with the Engineer, to gage the thickness of shotcrete applied.

- I. Vertical or near vertical surface application shall commence at the bottom. Layer thickness shall be governed by the requirement that the material shall not sag.
- J. Areas of Work shall be properly compacted and bonded and free from honeycombing, lamination, dry or 'sandy' patches, voids, sagged or slumped material, rebound, excessive cracking and over spray.
- K. Provide weep holes in the shotcrete to release water pressure build-up behind the shotcrete as required.
- L. During the application of shotcrete, ensure that ventilation system is adequate and provide such other measures as are necessary to ensure the safety of workmen. This shall include furnishing of face protection for nozzle men.
- M. A complete stand-by shotcrete system including all ancillary equipment shall be available for the duration of shotcreting operations. The equipment shall be tested, cleaned and maintained on a weekly basis in accordance with the manufacturers instructions.

3.4 JOINT CONSTRUCTION

- A. Joints shall be made whenever shotcreting is interrupted or stopped for a period of time that allows the in-place shotcrete to set or harden.
- B. Shotcrete joints shall be tapered from full thickness to zero over a distance of 12 to 24 inches.
- C. Prior to placing additional shotcrete, the tapered joint surface and adjacent rock shall be wet sandblasted and washed to break the mortar surface and clean away any laitance, rebound, or other contamination. High-pressure air/water jets may be used in lieu of wet sandblasting if satisfactory results can be demonstrated to the Engineer.
- D. The wet, cleaned surface shall then be coated with a rich mortar paste using the shotcrete equipment. Alternately, the surface may be coated with a cement-water paste consisting of no more than 6 gallons of water per sack of cement, after which the shotcrete mix shall be applied. The shotcrete mix may be applied directly to the wet, cleaned surface if rebound during the initial application results in a rich mortar coating on the joint surface free of trapped rebound, voids, or objectionable lamination and satisfactory to the Engineer.

3.5 TESTS AND INSPECTIONS

- A. Coring Shotcrete:
 - 1. Identify, in accordance with methods accepted by the Engineer, improper placement techniques and areas of defective shotcrete in the field for immediate correction and repair.
 - 2. Final acceptance of in-place shotcrete shall be determined from tests on cores taken from the completed Work. If necessary, prepare test panels to meet the testing frequencies specified below. Such test panels shall be prepared as

required for prequalification of nozzlemen and mixes and as required by the Engineer.

3. Take and prepare cores at locations selected by the Engineer. Cores shall be 3-inch in diameter and shall be of sufficient length to permit evaluation of the bond between the shotcrete and substrate. Replace cores, which are unsuitable for testing, at no additional cost to the Cabinet. Cores shall be labeled to indicate the location within the Work.
4. Thickness of shotcrete shall be determined to the nearest 0.1 inch by averaging the results of three measurements of the length of the shotcrete core.
5. Cores shall be trimmed, capped, moisture conditioned and tested in accordance with ASTM C1140.
6. Density shall be determined by measuring the length and diameter and weight of the trimmed core specimens prior to capping for unconfined compression testing. Reporting of densities of saturated shotcrete cores shall be in units of pounds per cubic inch.
7. Shotcrete in-place shall be considered acceptable if the cored or broken surfaces are dense and free of laminations or sand pockets. There is no evidence of honeycomb or voids in the shotcrete cores contain no evidence of poor bond between the substrate and the shotcrete. The thickness of shotcrete is as specified and as shown on the Contract Drawings. The average strength of three cores meets or exceeds 85 percent of the specified strength, and no individual core has a strength less than 75 percent of that specified strength.
8. Indirect methods, such as sounding, may also be used to help assess the extent of defective areas. Defective areas shall be removed and new shotcrete cover shall be applied.
9. Compressive strength tests shall be carried out on prepared cores taken from shotcrete in the Work measuring 3 inches diameter and 3 inches in length, or of other size subject to approval of the Engineer.
10. Where test results of core specimens fail to meet the core strength requirements, cut out defective shotcrete area and replace.

B. Gradation of Aggregate:

1. Blended aggregate shall be sampled for gradation analysis at least once each day during shotcreting operations and as requested by the Engineer. Gradation analysis will be performed by the Engineer's testing laboratory.
2. Gradation shall be determined by sieve analysis in accordance with ASTM C136, except that moistening of samples prior to sample splitting will be optional, and oven drying of samples at 230 F will be optional.
3. Samples of both fine and coarse aggregate shall be taken prior to shotcrete placement and whenever the quality of the material is questionable to determine cleanliness, soundness, resistance to abrasion, adverse reactivity, and presence of deleterious substances in accordance with ASTM C33.

C. Moisture Content of Aggregate:

1. Moisture content of the aggregate shall be determined in accordance with ASTM C566 at least once each day during shotcreting operations and as requested by the Engineer.
2. The moisture content of the shotcrete aggregate shall be between 3 and 6 percent.

- D. Water Quality Tests:
1. Deliver samples of the water and cement to be used in shotcreting to the Engineer for testing at least 30 days prior to the start of shotcrete operations and whenever the source or seasonal quality of the water is changed.
 2. The quality of water for shotcrete shall be tested by using it to prepare six 2-inch cube specimens in accordance with ASTM C109 and preparing six similar cube specimens using distilled or reagent grade water. Three specimens from each group shall be tested in compression at seven days of age and the remaining three at 28 days. The compressive strength developed by the cubes incorporating the water for shotcrete shall be at least 90 percent of the strength developed by the cubes containing the distilled water.
- E. Frequency of Testing during Construction:
1. Furnish three-inch diameter standard core test specimens at the rate of three for each 50 cubic yards of material.
 2. Cores shall be taken from completed Work or from test panels at locations agreed with the Engineer. During production shotcreting, areas where cores shall be taken shall be prepared by local thickening of the shotcrete being placed in the Work.
 3. At the discretion of the Engineer, test specimens may be called for at the reduced rate of three for each 100 cubic yards of material after application of the first 500 cubic yards of shotcrete.

3.6 FINISHED SHOTCRETE SURFACES

- A. All unsound, honeycombed, poorly bonded, or otherwise defective shotcrete shall be removed in accordance with methods accepted by the Engineer. Broken edges or abrupt changes in thickness shall be cut or chipped so that the roughened surface is tapered towards the center of the cavity. Additional shotcrete may be applied directly to a clean, moist, green shotcrete surface, but hardened shotcrete surfaces shall be treated in the manner specified for joint surfaces in ACI 506.
- B. Shotcrete surface profiles shall conform to the general shape of the rock surface with some smoothing due to filling of irregular or over broken areas. The surface finish on the specified profile shall be a gun finish, "as shot".
- C. Patch the core holes with shotcrete materials premixed to the stiffest consistency that will permit tamping into place by use of hand or power rodding tools in accordance with ACI 301.
- D. Remove and dispose of all rebound shotcrete and waste.

3.7 DEFECTIVE SHOTCRETE

- A. Shotcrete which lacks uniformity, exhibits segregation, honeycombing, lamination, shows cracking, lacks adequate bonding, lacks watertightness, or fails to meet the specified strength and toughness requirements shall be regarded as defective shotcrete. All defective material shall be removed and replaced immediately. Minimum area to be replaced: 12 in. x 12 in.

- B. The Engineer reserves the right to halt further placement of shotcrete not meeting specified requirements, or to order removal and replacement of defective shotcrete without additional cost.

END SECTION

SECTION 31 09 13

INSTRUMENTATION AND MONITORING

PART 1 GENERAL

1.1 SUMMARY

- A. The Work specified in this Section includes furnishing, installing, and monitoring of geotechnical instrumentation, as well as repair, calibration and maintenance of the same, to monitor ground movements within, around, and above open excavations, and tunnel excavations and to monitor ground water levels as indicated on the Contract Drawings and specified herein.
- B. Instrumentation includes but is not limited to:
 - 1. Convergence Measurement Devices
 - 2. Multiple point and single point borehole extensometers
 - 3. Surface settlement markers
 - 4. Piezometers and stream flow measurement devices
 - 5. Remote readout equipment for indicated instrumentation
- C. Include additional instrumentation, data collection and interpretation that Contractor deems necessary to ensure safety of personnel and the Work.
- D. Prepare remedial and precautionary measures to be taken and implement them, based on the data obtained from the instrumentation or as directed by the Engineer.
- E. The instruments shall remain in place at the end of the project, or as directed by the Engineer
- F. Related Sections:
 - 1. Special Note For Blasting and Vibration
 - 2. Section 02 32 13 Geotechnical Investigation in Exploratory Tunnel
 - 3. Section 01 32 23 Tunnel Survey

1.2 REFERENCES

- A. Definitions
 - 1. Formal Baseline Reading: The reading that is closest to the average of three readings taken within 2 hours after instrument installation (or at an interval specified by the Manufacturer consistent with grout setting times as applicable) and agreed to by the Engineer and Contractor as being the one with which all subsequent readings will be compared to determine levels of change.
 - 2. Review Level:
 - a. The first and lowest instrument reading that triggers action to avoid damage to existing structures, or settlement of the ground surface.
 - b. At this value of instrumentation reading, the Engineer and Contractor jointly assess necessity of altering methods, rate or sequence of construction.

3. Alert Level:
 - a. The second and greater instrument reading that necessitates action to halt settlement and avoid damage to existing structures, or settlement of the ground surface.
 - b. At this value of instrumentation reading, immediately cease construction operations, make site and affected properties secure, and take necessary and agreed upon measures to mitigate unacceptable movements.
 - c. The action must be such as to ensure the Alert Level is not exceeded in subsequent construction.
4. Contractor's Data: Data resulting from Contractor's monitoring of any instrument including those installed by Contractor in addition to those specified herein.
5. Bench Mark: A capped length of pipe, isolated from surrounding ground by an outer casing and founded at depth in firm rock some distance from the Work so as to avoid disturbance by the construction operations. Deep benchmarks are used as control benchmarks for determining elevations of settlement reference points and other instruments.
6. Surface Settlement Markers (SSM): Fixed reference markers placed at the ground surface, which are monitored by optical survey methods to determine whether vertical displacements occur during construction.
7. Surface Monitoring Points: placed at the ground surface, which are monitored by optical survey methods to determine whether vertical displacements occur during construction and used for precise survey and leveling as required by the Engineer.
8. Single Point Borehole Extensometers (SPBX): Instruments installed in a drilled hole to monitor ground deformations during construction. A single point borehole extensometer consists of an anchor at selected positioned length within the hole, with a rod extending to a readout head at the ground surface or tunnel excavation profile. Deformation is determined by measurements of movement of the anchor relative to the readout head and by optical surveying of the readout head itself, where applicable. Single point borehole extensometers in rock shall utilize rod extensometers in plastic sleeve with anchors encapsulated in cement grout backfill.
9. Multiple Point Borehole Extensometers (MPBX): Instruments installed in a drilled borehole to monitor ground deformations during construction. A multiple point borehole extensometer consists of two or more anchors at selected positions within the borehole, with rods extending to a readout head at the ground surface or tunnel excavation profile. Deformation is determined by measurements of movement of each anchor relative to the readout head and by optical surveying of the readout head itself, where applicable. Multiple point borehole extensometers in rock shall utilize rod extensometers in plastic sleeve with anchors encapsulated in cement grout backfill and wire extensometers with spring loaded anchors where specified in the Contract Drawings.

10. Convergence Monitoring Instruments: Instruments used to determine relative movement between two points.
11. Convergence Array: An arrangement of survey targets or anchors positioned on the surface of the excavation to determine dimension distance between them or which can be used by survey methods to determine change in three dimensional coordinates.
12. Piezometers: A sensor that is used to monitor fluid pressures or groundwater level.
13. Flow Meter: Flowmeters shall consist of surface flow gauges to determine the quantity of water flow on open drainage channels as shown on the Contract Drawings.
14. Automatic Weather Station: Automatic weather station shall consist of a rain gauge adjacent to the Contractor's working area to provide correlation to stream flow and potential run-off quantities.
15. Remote Readout: A data acquisition system consisting of an appropriate electrical transducer data logger components, data retrieval components, and software components fully compatible with Automated Data Acquisition System (ADAS)
16. Facility: An existing building, landscape garden feature, roadway, element of a utility system, or structure other than the Exploratory Tunnel to be built under this Contract.
17. Automated Motorized Total Station (AMTS): The integration of motorized total stations (theodolites) into a system to enable automated 3-dimensional displacement measurements.
18. Tunnel Instrument Station: A fixed instrument mount located on excavated surface of tunnel on which a theodolite or AMTS can be mounted, removed and precisely located or relocated such than line of site visibility to a convergence array can be achieved.
19. Automated Data Acquisition System (ADAS): Shall consist of a data logger, or series of data loggers, software, laptop computer, and dedicated on-site computer at the Engineer's office.

1.3 PERFORMANCE REQUIREMENTS:

- A. Engage the services of experienced geotechnical and structural instrumentation consultant(s) or experienced specialist subcontractors in specific areas of expertise unless the Contractor has personnel who are accepted by the Engineer and are suitably experienced to undertake the Work.

- B. Surveyor Qualifications: Surveying for settlement monitoring shall be performed by a land surveyor licensed in the Commonwealth of Kentucky with previous experience surveying for the detection of structural or surface deformations and underground survey.
- C. A factory calibration shall be conducted on all instruments before shipment. Certification shall be provided to indicate that the test equipment used for this purpose is calibrated and maintained in accordance with the test equipment manufacturer's calibration requirements and that, where applicable, calibrations are traceable to the National Institute of Standards and Technology.
- D. A final quality assurance inspection shall be made before shipment. During the inspection, a checklist shall be completed to indicate each inspection and test detail. A completed copy of the checklist shall be supplied with each instrument.
- E. Provide the manufacturer's warranty for each unit of equipment furnished by Contractor.
- F. Qualifications for Contractor's Instrumentation Personnel:
 - 1. Contractor's instrumentation personnel, who are responsible for furnishing and installing all geotechnical and structural instrumentation, maintaining instrumentation, as required, shall have the qualifications specified herein. These personnel may be on the staff of Contractor or may be on the staff of a specialist instrumentation subcontractor.
 - 2. Contractor's instrumentation personnel shall include a qualified Geotechnical Instrumentation Engineer who is a registered Professional Engineer, who has a minimum of a Bachelor of Science degree in Civil Engineering, and who has at least four years of experience in installation and monitoring of the types of instruments specified herein and in interpreting instrumentation data. An equally qualified Engineering Geologist is also acceptable as the Geotechnical Instrumentation Engineer. The Geotechnical Instrumentation Engineer shall:
 - a. Prepare detailed step-by-step procedures and bar chart schedule for the installation of all instruments specified herein.
 - b. Be on-site, supervise, and conduct the-pre-installation and post-installation acceptance tests of each type of instrument.
 - c. Be on-site and supervise at least the first five installations of each type of instrument.
 - d. Supervise and direct technicians and be responsible for instrument installation as required by the Contract Drawings and Specifications. This person is to be physically present at the installation site(s) to directly supervise the installations.
 - e. Supervise and maintain the geotechnical instruments and automated data acquisition system.
- G. Employ qualified technicians with a minimum of 2 years experience in the installation of geotechnical instrumentation similar to that specified herein. Written documentation of qualifications shall be submitted to the Engineer before installation of instrumentation devices begins.

- H. The installation and baseline reading of instruments and execution of geotechnical testing shall be undertaken by a specialist subcontractor unless the Contractor has personnel who accepted by the Engineer are suitably experienced to undertake the Work.
- I. Install all instruments within 1 foot of the location shown on the Drawings.
- J. Install multiple point borehole extensometers within 2 degrees of alignment shown on the Drawings.
- K. Should actual field conditions prohibit installation at the location and elevations as shown on the Contract Drawings or as specified herein, obtain prior acceptance from the Engineer for new instrument location and elevation.

1.4 SUBMITTALS

- A. Submit personnel qualifications as specified herein.
- B. Shop Drawings: Submit the Shop Drawings listed below, as prepared by qualified specialists submitted above.
 - 1. Instrument Installation Schedule: Submit the proposed schedule for installing instruments shown on the Contract Drawings.
 - 2. Description of methods for installing and protecting multiple point borehole extensometers, and surface settlement markers.
 - 3. Materials and mix portions for grout for installing multiple point borehole extensometers.
 - 4. Following installation of the instruments, submit As-Built drawings showing the exact installed location, the instrument identification number, the instrument type, the installation date and time, the heading station, on the installation date and the anchor or tip elevation and instrument length, when and where applicable. Include details of installed instruments, accessories and protective measures including all dimensions and materials used.
 - 5. Forms for reporting instrumentation data.
- C. Reports and Records: Provide reports of monitoring data to the Engineer in accordance with the requirements specified herein.
- D. Product Data and Samples:
 - 1. Submit all applicable manufacturer's literature describing operation and maintenance procedures for the tape extensometers, multiple point borehole extensometer instruments and readout units, including probes. Provide manufacturer's brochures on each product. Provide product description and drawings of any accessories for extensometer installations.
 - 2. Submit samples of multiple point borehole extensometer anchors, rod and protective tubing, as applicable.
 - 3. Certificates: For each instrument to be installed submit, as applicable, a certificate issued by the instrument's manufacturer stating that the manufacturer has inspected and tested each instrument before it leaves the factory to see that the instrument is working correctly and has no defects or missing parts.

1.5 SCHEDULE OF BID ITEMS

A. Measurement

1. General principles for instrumentation & monitoring measurements:

- a. The Cabinet will measure supply, including transportation to site and all handling; calibration; all Work, equipment and materials necessary to install the instruments in accordance with the Contract Documents including forming or drilling holes, recesses and surface preparation as applicable; protection and maintenance of the installations; establishment of zero readings; and disruptive effects on other Work. The Cabinet will also measure the cabling required to reach the common collection point of cables or datalogger and for all necessary incidentals.
- b. The Cabinet will measure reading of instruments that shall include for all Work involved; supply of read-out units, measuring tapes, dial gauges and such like and any other equipment, materials and labor required for maintaining instrumentation in working order, all field Work in taking sufficient readings to establish acceptable baseline values, installation and maintenance reports to the Engineer.
- c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) The instrumentation incorrectly installed or correctly installed but subsequently damaged or not maintained to the satisfaction of the Engineer.
 - 2) Facilitate access to carry out instrumentation readings and the time taking for such readings.
 - 3) The readings or payment submitted and subsequently found to be incorrect.

2. Convergence Array: Survey Target:

- a. The Cabinet will measure survey targets installed at each 5-point convergence array in the tunnel and each 6-point convergence array in the exploration bays.
- b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply of convergence bolts and survey targets, drilling of holes, installation of bolts and survey targets, establishment of base readings, taking of routine readings as defined in the Specification and protection and maintenance of the installations. The reading of one convergence array will be deemed to include the taking of sufficient readings to establish acceptable Baseline average values for each line in the array.

3. Convergence Array: Tape Extensometer

- a. The Cabinet will measure tape extensometers installed at each 5-point convergence array in the tunnel.
- b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:

- 1) Supply of convergence anchors, drilling of holes, installation of anchors, establishment of base readings, taking of routine readings as defined in the Specification and protection and maintenance of the installations. The reading of one convergence array will be deemed to include the taking of sufficient readings to establish acceptable Baseline average values for each line in the array.
4. Surface Monitoring Point (pin type)
 - a. The Cabinet will measure surface monitoring points installed at each individual array of 5 leveling pins.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of an array of 5 precise leveling pins, establishment of base readings, taking of routine readings as defined in the Specification, together with initial interpretation and protection and maintenance of the installations. The reading of one settlement array will be deemed to include the taking of sufficient readings to establish acceptable Baseline average values for each precise leveling pin in the array.
5. Surface Settlement Marker (rebar type)
 - a. The Cabinet will measure surface settlement markers installed at each individual array of 4 settlement markers.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply of surface settlement markers, excavation of holes, installation of markers, establishment of base readings, taking of routine readings as defined in the Specification together with initial interpretation, and protection and maintenance of the installations. The reading of one settlement array will be deemed to include the taking of sufficient readings to establish acceptable Baseline average values for each settlement marker in the array.
6. Flowmeter
 - a. The Cabinet will measure installed flowmeters by each individual unit.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each flowmeter, calibration, establishment of baseline readings, connection to the Automated Data Acquisition System for automatic reading together with interpretation, and protection and maintenance of the installations.
7. Weather Station
 - a. The Cabinet will measure installed weather stations by each individual unit.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of a weather station, calibration, connection to the Automated Data Acquisition System for automatic reading

together with establishment of acceptable Baseline readings, and protection and maintenance of the installations.

8. **Vibration Monitoring**
 - a. The Cabinet will measure installed vibration monitoring equipment and all ancillaries' instruments defined under Special Note for Blasting and Vibration.
 - b. The Cabinet will measure consumable recording media of vibration monitoring equipment and all ancillaries by the number of vibration monitoring instruments installed as defined under Special Note for Blasting and Vibration.
 - c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply of all equipment, transport, calibration, reading, reports, maintenance, labor and materials required to monitor vibration for the duration of the Contract.
 - 2) Supply of all equipment, transport, calibration, maintenance, labor and materials required furnishing and maintaining the instruments for the duration of the Contract.

9. **Single-point Borehole Extensometers (SPBX)**
 - a. The Cabinet will measure single-point rod (Dual Height Wire) extensometers installed by each individual unit. A distinction will be made for the installation length.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each single-point rod extensometer, calibration, establishment of baseline readings, together with protection and maintenance of the installations. Subsequent connection to the Automated Data Acquisition System for automatic reading together with establishment of acceptable Baseline readings, and protection and maintenance of the installations.
 - 2) Provide access to enable readings to be taken at the times specified or as directed by the Engineer during the interim period where manual readings are required until ADAS connection is made.

10. **Multiple-point Borehole Extensometer: 3-and 4 point (MPBX: 3-4 point)**
 - a. The Cabinet will measure multiple-point borehole extensometers installed by each individual unit. A distinction will be made for the installation length.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each multiple-point rod extensometer, calibration, establishment of baseline readings, together with protection and maintenance of the installations. Then subsequent connection to the Automated Data Acquisition System for automatic reading together with establishment of acceptable Baseline readings, and protection and maintenance of the installations.

- 2) Provide access to enable readings to be taken at the times specified or as directed by the Engineer during the interim period where manual readings are required until ADAS connection is made.
11. Piezometer: in-tunnel
 - a. The Cabinet will measure in-tunnel piezometers installed by each individual unit.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each individual in-tunnel piezometer location as Specified or instructed by the Engineer, calibration, establishment of baseline readings, together with protection and maintenance of the installations.
 - 2) Provide access to enable readings to be taken at the times specified or as directed by the Engineer during the interim period where manual readings are required until ADAS connection is made.
 - 3) Supply and installation of each in-tunnel piezometer, calibration, establishment of base readings, together with interpretation, and protection and maintenance of the installations.
 12. Piezometer: surface level
 - a. The Cabinet will measure piezometers installed in existing observation wells by each individual unit.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each individual surface level piezometer location as Specified or instructed by the Engineer calibration, establishment of baseline readings, together with protection and maintenance of the installations.
 - 2) Connection to the Automated Data Acquisition System for automatic reading together with protection and maintenance of the installations.
 - 3) Provide access to enable readings to be taken at the times specified or as directed by the Engineer during the interim period where manual readings are required until ADAS connection is made.
 13. Portal Face Survey Target
 - a. The Cabinet will measure portal face survey targets installed by each individual unit.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply of bolts and survey targets, drilling of holes, installation of bolts and survey targets, establishment of base readings, and protection and maintenance of the installations. A baseline reading of the portal face survey targets will be deemed to include the taking of sufficient readings to establish acceptable average values for each target.

14. Temperature and Humidity Sensors
 - a. The Cabinet will measure installed sensors by each individual unit.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each combined temperature and humidity sensor, calibration, establishment of base readings, connection to the Automated Data Acquisition System for automatic reading together with protection and maintenance of the installations.

15. Borehole Inspection Camera
 - a. The Cabinet will measure the supply of a borehole inspection camera and for maintaining the camera.
 - b. The Cabinet will not measure the access by the Engineer for use of the camera for payment and will consider it incidental to this item of work.

16. Rockbolt Trials
 - a. The Cabinet will measure rockbolt trials completed as directed by the Engineer for the testing of up to 20 number 20-ft long rockbolts to be installed at locations to be directed by the Engineer.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Site pull out trials shall include for the supply, installation, and grouting of the rockbolts to the Engineer's satisfaction, and provision and testing the reinforcement utilizing the cited procedures. Calibration of testing equipment shall conform to procedures

17. In-tunnel Automatic Readout Transducers
 - a. The Cabinet will measure in-tunnel and portal automatic readout transducers installed by each individual unit.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each in-tunnel transducer for extensometer anchor rod, or piezometer and shall include calibration, establishment of base readings from manual readout, provision of a suitable data logger for automatically taking and recording readings, data retrieval components, and software components as defined in the Specification together with interpretation, and protection and maintenance of the installations.

18. Surface Automatic Readout Transducers
 - a. The Cabinet will measure surface automatic readout transducers installed by each individual piezometer unit for monitoring of existing surface wells.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of each surface piezometer transducer and shall include calibration, establishment of base readings from manual readout, provision of a suitable data logger for

automatically taking and recording readings, data retrieval components, and software components as defined in the Specification together with interpretation, and protection and maintenance of the installations.

19. Automated Data Acquisition System (ADAS)
 - a. The Cabinet will measure Automated Data Acquisition System (ADAS) installed by the complete system comprising of; a data logger, or series of data loggers, software, laptop computer, and dedicated on-site computer at the Engineer’s office for monitoring of all contract-monitoring transducers.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Supply and installation of all components as defined in the Specification together with interpretation, and protection and maintenance of the installations.

B. Payment

1. The Cabinet will make payment for the completed and accepted quantities under the following:

Code	Payment Item	Pay Unit
Surface Instrumentation:		
22277NN	Portal Face Survey Target, supply, install, protect and maintain	Each
22278NN	Portal Face Survey Target, initial calibration reading	Each
22279NN	Surface Monitoring Point Array (pin), supply, install protect and maintain, 5-point array	Each
22280NN	Surface Monitoring Point Array (pin), initial calibration reading	Each
22281NN	Surface Settlement Marker Array (rebar), supply, install protect and maintain, 4 point array	Each
22282NN	Surface Settlement Marker Array (rebar), initial calibration reading	Each
22283NN	Flowmeter, supply, install, protect and maintain	Each
22284NN	Weather Station, supply, install, protect and maintain	Each
22289NN	Piezometer: surface level, supply, install, protect and maintain	Each
22291NN	Deep Benchmark Into Rock - supply, install, protect and maintain	Each
Tunnel Instrumentation:		
22292NN	Convergence Array: Survey Target, 5-point, supply & install	Each
22293NN	Convergence Array: Survey Target, 6-point, supply & install	Each
22294NN	Convergence Array: Survey Target, 5-point, initial calibration reading	Each
22295NN	Convergence Array: Survey Target, 6-point, initial calibration reading	Each
22296NN	Supply Tape Extensometer	Each
22297NN	Convergence Array: Tape Extensometer, 5-point array,	

	supply & install	Each
22298NN	Convergence Array: Tape Extensometer, 5-point array, initial calibration reading	Each
22299NN	Dual Height Wire Extensometer, 2ft, supply, install, perform initial calibration reading	Each
22300NN	Dual Height Wire Extensometer, 8ft, supply, install, perform initial calibration reading	Each
22301NN	MPBX: 3-point, Hole Depth 16 feet, anchors at 2, 7, 15 ft, supply, install, perform initial calibration reading (Wire Extensometer)	Each
22302NN	MPBX: 3-point, Hole Depth 21 feet, anchors at 2, 8, 20 ft, supply & install (Rod Extensometer)	Each
22303NN	MPBX: 3-point, initial calibration reading (Rod Extensometer)	Each
22304NN	MPBX: 4-point, Hole Depth 28 feet, anchors at 2, 5, 18, 27 ft, supply & install (Wire Extensometer)	Each
22305NN	MPBX: 4-point, initial calibration reading (Wire Extensometer)	Each
22306NN	Piezometer: in-tunnel, supply & install	Each
22307NN	Piezometer: in-tunnel, Initial calibration reading	Each
22308NN	Borehole Inspection Camera	Each
22309NN	Rock bolt trials	Lump sum
22310NN	Automatic remote readout transducer - extensometer	Each
22311NN	Automatic remote readout transducer - in-tunnel piezometer	Each
22312NN	Automatic remote readout transducer - surface piezometer	Each
22313NN	Automatic Data Acquisition System	Each

PART 2 PRODUCTS

2.1 MATERIALS

- A. General: All instrumentation materials, including readout units, shall remain the property of the Contractor following completion of the Contract.
- B. Provide the services of an authorized manufacturer's representative who shall visit the site and provide training as necessary for the Contractor's personnel to properly install these devices. The authorized representative shall inspect and approve at least the first five installations for each type of instrumentation.
- C. Each instrument specified herein shall be the product of an acceptable manufacturer currently engaged in manufacturing geotechnical instrumentation hardware of the specified types
- D. Multiple point borehole extensometers: Multiple point borehole extensometers shall be installed at the locations as indicated on the Contract Drawings. The following materials and equipment shall be provided.
 1. Rock Rod Extensometer: Multiple point borehole rod extensometers in rock shall be Model No. A-3 manufactured by Geokon, Inc., Lebanon, NH; Model No. 51836124 (head), Model No. 51815852 (anchors), and associated components manufactured by Slope Indicator Company, Seattle, WA; or approved equal. Extensometers shall

- be four-position type with four groutable anchors as specified and shall be furnished complete with all heads, rods, connectors, cables, protective tubes, accessories and adequate spare parts necessary for installation and maintenance as recommended by the manufacturer
2. Rock Wire Extensometer: Multiple point borehole wire extensometers in rock shall be tensioned wire connected to spring loaded anchors as manufactured by Rock Mechanics Technology LTD Brethby, UK, or approved equal.
 3. Anchor Positions: One anchor shall be installed at positions indicated in the Instrumentation Installation Schedule specified in Subparagraph 1.4.B.1 above.
 4. Micrometer: Each extensometer unit shall be furnished with a compatible micrometer such as Model No. 1400-4 manufactured by Geokon, Inc., Lebanon, NH; Model No. 518096 manufactured by Slope Indicator Company, Seattle, WA; or equal.
- E. Convergence Monitoring Instruments may consist of the following, Tape Extensometers or optical systems. The first convergence array in the Exploratory Tunnel and first convergence array in an exploration bay shall be equipped with both mechanical and optical target systems.
- F. Tape Extensometers: Tape extensometers reference points shall be installed in the tunnel at the locations specified on the Drawings.
1. Tape extensometers shall be Model No. 51811500 manufactured by the Slope Indicator Company (SINCO) of Seattle, Washington, or Model No. CX-100 manufactured by ROCTEST, Inc. of Plattsburgh, New York or approved equal.
 2. Reference heads shall consist of stainless steel eyebolts supplied by the tape extensometer manufacturer. Reference heads shall be capable of attachment to the flange of the structural steel ribs or into the exposed tunnel surface, as shown on the Drawings.
 3. Provide rigid calibration frame.
 4. Provide two (2) tape extensometers to enable independent readings by the Contractor and the Engineer.
- G. Optical Convergence system: This shall be a proprietary laser distance measuring device that is accurate to ± 0.06 inch.
1. The optical convergence system shall be Model No. A6 manufactured by Leica Geosystems of Norcross, GA, or approved equal.
 2. The system shall have a measuring range of 0.16 to 650 feet and capable of wireless data transfer.
 3. The optical monitoring targets to be utilized in convergence array shall be compatible with standard AMTS equipment and the specified laser distance measuring device.
- H. Surface Settlement Markers and Deep Bench Markers: Surface settlement markers shall be installed at the locations specified in the Drawings.
1. SSM shall be constructed of #6 rebar installed as shown on the Contract Drawings. The top of pipe shall be installed approximately 6 inches below the ground surface. The SSM shall be protected with a minimum 6 inch diameter surface box with lid installed flush to the ground surface and extending at least 12 inches in depth.

2. Protect settlement markers with a 6 inch minimum dimension cast iron valve box installed flush with the ground surface and extending at least 12 inches below grade.
 3. Vertical control is to be determined by optical survey methods
 4. A deep bench marker is a surface settlement marker installed at a distance of 150 feet from the exploratory tunnel centerline as instructed by the Contractor and agreed with the Engineer and within a line of site for surveying to tunnel instrumentation or survey stations.
- I. Surface Monitoring Points shall be installed at the locations specified in the Drawings.
1. Surface Monitoring Points will consist of a masonry nail driven into roadway pavement with metal identification tag suitable for precise survey and leveling as required by the Engineer.
- J. Piezometers in-tunnel: Vibrating wire piezometers shall be installed in slotted PVC pipe exposed to water inflow in boreholes drilled in rock as shown on the contract drawings from within the tunnel..
1. Piezometers shall be vibrating wire piezometers, Model 4500S manufactured by Geokon of Lebanon, NH, or Model 52611026 manufactured by Slope Indicator of Mukilteo, WA, or approved equal.
 2. Piezometers shall have a rated range of 50 psi, a resolution of +- 0.025%, and an accuracy of +- 0.1%.
 3. Piezometers shall be capable of wireless readout.
- K. Piezometers surface level: Vibrating wire piezometers shall be installed in existing standpipe wells also shown on the Contract Drawings.
1. Piezometers shall be vibrating wire piezometers, Model 4500S manufactured by Geokon of Lebanon, NH, or Model 52611026 manufactured by Slope Indicator of Mukilteo, WA, or approved equal.
 2. Piezometers shall have a rated range of 50 psi, a resolution of +- 0.025%, and an accuracy of +- 0.1%.
 3. Piezometers shall be capable of wireless readout.
- L. Automatic Flow Meter shall be installed at the locations shown in the Drawings.
1. Flow meters shall be a portable area-velocity open channel flow meter, Model FLOCM3-P Mainstream Open Channel Flow Meter, manufactured by Fuji Electric Corporation of America of Saddle Brook, NJ, or approved equal.
 2. The flow meter shall have a flow range of up to 17 fps, with a velocity resolution of 0.003 fps and a level resolution of 0.003 feet; it shall have a velocity accuracy of +- 2%.
- M. Automatic Weather Station
1. Automatic weather stations shall be consist of an automatic rain gauge with a data logger, and shall be compliant with National Weather Service (NWS) specifications for statistical accuracy.
 2. The rain gauge shall consist of a rain collector, and shall be mounted three feet above the ground on a three foot mounting post (in compliance with NWS specification). The rainfall shall be recorded with a remote data logger.
 3. The tipping bucket rain gauge shall be calibrated to 0.01 inches / 0.25 mm per tip.

4. The rain level remote data logger shall fit within the rain gauge and log total rainfall at a one-minute resolution for up to for one year. It shall be the Model RainLog data logger, manufactured by Rainwise of Bar Harbor, ME, or approved equal. It shall also consist of the associated RL-Loader 2 software, which shall be used to configure and download data from the RainLog device.
- N. Automated Motorized Total Station (AMTS): The integration of motorized total stations (theodolites) into a system to enable automated 3-dimensional displacement measurements.
1. The total stations shall be Model No. TCA 1800 manufactured by Leica Geosystems of Norcross, GA, or approved equal.
 2. The total stations shall be capable of wireless automatic readout.
- O. Automatic readout:
1. Shall be a complete data acquisition system consisting of data logger components, data retrieval components, and software components.
 2. Identify compatible data logger that can accommodate all sensors in a given exploration bay, namely extensometers, and piezometers.
 3. A control software program shall be used to create monitoring programs and to retrieve data from logger to personal computer.
 4. The selected software programs shall be compatible with the selected data loggers to provide efficient data acquisition.
 5. The data logger shall be a fully programmable controller with non-volatile memory and a battery backed clock contained in a rugged sealed module. It shall be a Model CR10X manufactured by Campbell Scientific Inc. of Logan, UT, or approved equal.
- P. Borehole Inspection Camera:
1. The borehole inspection camera shall be a video inspection system with a rotatable (180° vertical and 360° horizontal) camera head, 120-feet of cable, reel, and monitor, with an additional 26-mm non rotatable camera head.
 2. The borehole inspection camera shall be a Wohler VIS-2000 video inspection system, with distributed by Mortex USA, Inc. of San Jose, CA, or approved equal.
- Q. Rock Bolt Trials
1. Carry out a series of on-site pull tests comprising rock bolt reinforcement stressing, load testing and performance trials on high yield 150 KSI grade ASTM A-722-98 under All-thread bar of grade ASTM A-722-98 of 1-3/8-inch nominal diameter within percussive drilled holes in the range 1-7/8-inch to 2-1/4 inch diameter under the supervision of the Engineer to evaluate potential rock bolt systems to be utilized in the future highway tunnel contract and particularly to evaluate the ultimate bond strength of various interfaces including (as applicable); grout/rock, threadbar shank/grout, threadbar corrosion protection/grout.
 2. The tests will require the drilling and installation of up to 20 Number 20-foot bars in locations directed by the Engineer any where within the Exploratory tunnel excavation or in suitable rock faces exposed adjacent to the Access Ramp. The bars shall be anchored by appropriate resin grout capsules or cement grout to varying bond lengths directed by the Engineer in the various rock types described within the GDR with the remaining 'free length' of bar being left ungrouted between the grout anchorage and the mouth of the hole. In each instance, the grouted bar shall be

subject to stressing and load testing procedures as defined in the recommendations for acceptance testing defined in section 8.0 of "Recommendations for Pre-stressed Rock and Soil Anchors' Fourth Edition, 2004, published by the Post Tensioning Institute, 8601 N Black Canyon Highway, Suite 103, Phoenix, AZ 85308. Tel: 1-(602) 870 7540.

- R. Automated Data Acquisition System (ADAS):
1. Shall consist of a data logger, or series of data loggers, software, laptop computer, and dedicated on-site computer at the Engineer's office.
 2. Data logger(s) and software shall be supplied by Geokon of Lebanon, NH, or approved equal, and shall be capable of a complete set of readings in a period of five minutes for each exploration bay. The data loggers and software shall be capable of reading, storing the data, and transmitting the data to the on-site computer.
 3. The data logger(s) shall be equipped with a backup battery, modem, and enough memory to store a minimum of three months of data.
 4. A laptop computer shall be supplied for use during installation and maintenance. The on-site computer shall be used for data collection, reduction, and plotting, as well as remote programming and real-time monitoring. Both computers shall be equipped with a CD-RW drive for data backup and a minimum 56-K modem for remote access.
 5. The output data shall be in a format that is acceptable to the Engineer.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Instrumentation shall be installed at the locations shown on the Drawings, prior to start of any tunneling, or open excavation construction and as accepted by the Engineer. Instruments shall be installed in accordance with the instrument installation schedule as specified herein.
- B. Existing Conditions: Locate conduits and underground utilities in all areas where all instruments are to be drilled and installed. Notification of utility companies shall be performed. Instrument locations shall be modified, as accepted by the Engineer, to avoid interference with the existing conduits, utilities, and existing instrumentation on the ground surface. Repair damage to existing utilities resulting from instrument installations at no additional cost to the Cabinet.
- C. Ground Surface Data Produced by Others: Extensometer holes and piezometers drilled from the ground surface by others will exist. The instrument data as well as surface geophysical data will be provided to the Contractor by the Engineer. Updated data from such instruments will be provided on a regular basis by the Engineer to the Contractor and no later than 24-hours after any instrument reading.
- D. All instruments shall be clearly marked, labeled, and protected to avoid being covered, obstructed or otherwise damaged by construction operations or the general public. Both protective housing and box or vault covers shall be marked.

- E. Immediately following installation, the location of the top of all instruments shall be surveyed to provide horizontal and vertical coordinates.
- F. Carry out Acceptance Readings after instrument installation of each instrument as soon as practicable, but no later than 12 hours after installation
- G. When manually read instruments are transferred to automatic readout, a further set of formal manual readings and new baseline readings for automatic readout shall be required to be established, the Engineer may be present, following installation of the readout equipment.
- H. Provide all the necessary maintenance and equipment for the installation and reading of the instruments. Arrange for the Work to be carried out at the locations shown on the Contract Drawings or where directed by the Engineer.
- I. Advise the Engineer in sufficient time of the intention to install instruments to allow the Engineer to witness the installation of instruments, installation of remote readout heads as appropriate, and taking of the baseline readings. The procedures for installations and reading of instruments and presentation of results shall be agreed with the Engineer prior to any Work being undertaken.
- J. Installation of instrumentation and all baseline readings shall be performed in the presence of the Engineer.
- K. All other instrument readings shall be performed at frequencies defined below. Notify Engineer at time of reading.
- L. Plot on graphs the results of all readings, prior to the installation of remote readout equipment (Engineer may be present) and copy to Engineer within 24 hours of each set of readings being taken.
- M. Locate air, water, pumping mains and the like to be clear of the instrumentation sight and reading lines.
- N. Where necessary ventilation ducting shall be provided with a removable or collapsible section at measuring stations to enable readings to be taken.
- O. Locate instruments in consultation and acceptance with the Engineer in positions that will cause the least disruption to the Contractor's Work. The Engineer's acceptance is necessary in order to locate the instruments consistent with design requirements.
- P. All instrumentation stations shall be clearly marked with an identifying reference number.
- Q. Installation of instrumentation shall be performed in the presence of the Engineer.

3.2 INSTALLATION SCHEDULE

- A. Prior to commencement of tunneling install:
 - 1. Multiple point borehole extensometer at portal
 - 2. Prepare seismograph locations

3. Surface settlement markers a minimum of 15 days prior to start of excavation at installation site.
 4. Piezometers in existing wells a minimum of 30 days in advance
 5. Flow meters in stream beds as shown on Contract Drawings a minimum of 15 days in advance
- B. During tunneling in line with advancing excavation headings install:
1. Single point extensometers and multipoint extensometers,
 2. Tape extensometer reference points and optical prism target holders in line with excavation advance but no later than one shift after excavation of the tunnel or exploration bay opening at the planned installation site.
 3. Piezometers

All the above underground instruments shall be recessed within the rock profile or protected from blast damage. Access shall be given so that instruments may be read manually at least once per shift until remote readout is installed as defined by agreed schedule with Engineer.

3.3 DATA COLLECTION AND MONITORING FREQUENCY

- A. Take instrumentation readings (Engineer may be present) and provide graph of results once the instruments have been installed and the Contractor's baseline readings have been agreed as acceptable by the Engineer. In the case of manual instrument reading, provide (Engineer may be present) updated readings within 24 hours to the Engineer. In the case of instruments fitted with Automatic Readout Transducers, update readings (Engineer may be present on installation of ADAS) of all instruments every 24 hours to the Engineer. When instrument readings are observed to have reached Review or Alert Levels, the Engineer shall be informed as per Subsection 3.4A and implement procedures according to Subsection 3.4B.
- B. The Engineer shall check and agree to the validity of formal baseline readings taken by the Contractor. All subsequent readings will be compared to the formal initial readings to determine levels of change.
- C. No instrument will be accepted or paid for until formal initial readings are agreed upon as specified herein.
- D. Surface Instrumentation
1. Data collection from surface instruments will be made at least:
 - a. Once per week during the period between instrument readings and the point of time when any active excavation will take place outside of a zone of two hundred feet surrounding the plan location of the relevant instrument
 - b. Once per shift during the period when any active excavation will take place within a zone of two hundred feet surrounding the plan location of the relevant instrument
 - c. And subsequently resume readings at once per week after excavation has exited the 200 foot zone
 2. Observation and inspection of key structures identified in the Special Note for Blasting and Vibration

3. Precise leveling of surface monitoring points at weekly intervals following baseline reading when the excavation is within 200 feet of installed points or more frequently should the Engineer consider field observations warrant.

E. Underground Instrumentation

1. Data collection from underground instruments will be made at least:
 - a. Once per shift during the period when any excavation will take place within a zone of one hundred feet from the plan location of the relevant instrument and once per day in a zone between five hundred feet from the plan location of the relevant instrument or until the installation of remote readout to a schedule agreed with the Engineer
 - b. Provide the Engineer, if required, with facility to perform additional readings of instruments supplemental to routine readings by Contractor.
 - c. The Contractor may take additional readings, (Engineer may be present), for their own purposes but shall provide such information to the Engineer within 24 hours. Any such readings shall be performed by a qualified instrument technician as outlined above.

- F. The Record data shall comprise as a minimum of the information listed below. Provide the record data, at the intervals specified above, in U.S. customary units such as feet, inches, pounds, etc:

1. Project name
2. Contract Name and Number
3. Instrument Type
4. Date and Time
5. Observer
6. Readout Unit Number
7. Instrument Number
8. Readings
9. Remarks
10. Visual Observations
11. Other Causal data including weather, temperature and construction activities

- G. Implement remote readout capabilities within 14 days of installation of an instrument array, or as agreed with the Engineer. A formal remote readout reading shall consist of the reading that is closest to the average of three non-automatic readings and confirmed by simultaneous duplicate reading with the remote readout system.

3.4 REVIEW AND ALERT LEVELS

- A. Immediately inform the Engineer when the following review and alert levels are reached:

1. Borehole Extensometers:
 - a. Review Level: 0.2 inches
 - b. Alert Level: 0.25 inches
2. Surface Settlement Markers:
 - a. Review Level: 0.125 inches
 - b. Alert Level: 0.3 inches
3. Surface Monitoring Point:

- a. Review Level: 0.125 inches
 - b. Alert Level: 0.3 inches
 4. Tunnel Convergence:
 - a. Review Level: 0.20 inches
 - b. Alert Level: 0.3 inches
 5. Portal Face Survey targets:
 - a. Review Level: 0.125 inches
 - b. Alert Level: 0.3 inches
- B. If a Review Level is reached:
1. Meet with the Engineer to discuss the need for response action(s)
 2. If directed by the Engineer, during the above meeting that a response action is needed, within 24 hours of receiving instrumentation data from the Contractor indicating that a Review Level has been reached, submit a detailed specific plan of action, based as appropriate on the generalized plan of action submitted previously.
 3. If directed by the Engineer, implement response action(s) within 24 hours of submitting a detailed specific plan of action, so that the Alert Level is not reached.
 4. Install additional instruments if directed by the Engineer.
- C. If an Alert Level is reached:
1. Meet with the Engineer to discuss the need for response action(s).
 2. If directed by the Engineer, during the above meeting, that a response action is needed within 24 hours of receiving instrumentation data from the Contractor indicating that an Alert Level has been reached, submit a detailed specific plan of action, based as appropriate on the generalized plan of action submitted previously.
 3. If directed by the Engineer, implement response action(s) within 24 hours of submitting a detailed specific plan of action, so that the Alert Level is not exceeded.
- D. Irrespective of the Review and Alert Levels, the Engineer is entitled to direct the Contractor to take response actions as appropriate when the observed ground movement, regardless of its magnitude, is deemed, as determined by the Engineer, to cause an unsafe excavation of the tunnel or potential damages to utilities and above ground properties.

3.5 REPORTING FREQUENCY AND FORMAT

- A. Submit one (1) copy of the instrument monitoring data to the Engineer, on forms accepted by the Engineer within 24 hours after the observation has been made.
- B. Submit reduced data and updated data plots of changes in ground water levels and ground movements within 2 working days after observations have been made.

3.6 INSTRUMENT PROTECTION, MAINTENANCE, AND REPAIR

- A. Protect the instruments from damage. Damaged instruments shall be replaced or repaired prior to continuing Work, or as required by the Engineer.
- B. Maintain the instruments as necessary with protective covers as agreed with the Engineer.

3.7 DISPOSITION OF INSTRUMENTS

A. Surface Settlement Markers:

1. All surface settlement markers on public property shall remain in place at the completion of the Contract.
2. Surface settlement markers on private property shall be removed following discussion with property owner during the cleanup, or remain in place as required by the Engineer.

B. All other instruments:

1. Remove salvageable instruments only when directed by the Engineer
2. Portable readout units furnished by the Contractor for data collection shall remain the property of the Contractor. Portable readout units used by Contractor during installation, during pre- and post-installation acceptance testing, and for collecting Contractor's Data shall remain the property of Contractor.
3. All salvaged instruments shall remain the property of Contractor.
4. Ensure that all instruments installed by Contractor and existing instruments installed by others shall be operational upon completion of the tunnel excavation and maintenance period, for possible later purchasing and monitoring by others.
5. If directed by the Engineer, remove and dispose of those portions of instruments constituting an obstruction. The Engineer will be the sole judge of whether or not removal is required.
6. For instruments installed in boreholes, the upper 2 feet of the instrument shall be removed, together with the ground surface protection. The remaining open portions of the instrument and casing shall be backfilled with cement grout up to a level 2 feet below the ground surface, and with lean concrete in the upper 2 feet.
7. New pavement patches shall be constructed, in paved areas, of the same material and to the same thickness as existing adjacent pavement.
8. Disturbed or damaged surfaces shall be restored to the condition existing before installation of the instrument.

END OF SECTION

SECTION 31 71 16.01

TUNNEL EXCAVATION BY DRILL AND BLAST

PART 1 GENERAL

1.1 SUMMARY

- A. The Work specified in this Section consists of drill and blast excavation of the Exploratory Tunnel and exploration bays, any enlargement of tunnel excavations, and all other pertinent activities necessary for the successful completion of the tunnel construction.
- B. All Work required for the construction of the Exploratory Tunnel and the exploration bays, including the installation of tunnel reinforcement and support elements, and all other pertinent activities shall be performed in accordance with the specific sections identified in Related Sections, and requirements specified herein.
- C. The excavated dimensions of the Exploratory Tunnel and exploration bays shall be in accordance with Contract Drawings. The crown geometry, height, and line/grade of the Exploratory Tunnel and the exploration bays as shown in the Contract Drawings shall be maintained along the entire length of the alignment. Any enlargements to the tunnel sidewalls and deepening of the tunnel invert for the convenience of the Contractor's operations shall be subject to the Engineer's review and approval and shall be at the Contractor's own expense.
- D. Related Sections:
- | | | |
|-----|---------------------|--|
| 1. | Special Note | For Submittal Procedures |
| 2. | Special Note | For Blasting and Vibration |
| 3. | Special Note | For Waste Sites |
| 4. | Section 01 35 00 | Safety Procedures for Tunnel Construction |
| 5. | Section 01 40 00 | Quality Requirements |
| 6. | Section 01 51 00 | Tunnel Ventilation and Utilities |
| 7. | Section 01 32 23 | Tunnel Surveying |
| 8. | Section 02 32 13 | Geotechnical Investigation in Exploratory Tunnel |
| 9. | Section 03 37 13 | Shotcrete |
| 10. | Section 31 09 13 | Instrumentation and Monitoring |
| 11. | Section 31 71 16.02 | Blasting |
| 12. | Section 31 71 26 | Probe Drilling and Grouting |
| 13. | Section 31 71 29 | Control and Removal of Tunnel Water |
| 14. | Section 31 72 13 | Rock Reinforcement and Support |

1.2 REFERENCES

- A. Definitions
1. Exploratory Tunnel: The tunnel as defined in the Contract Drawings.
 2. Exploration Bays: Excavated spaces, as defined in Plan and Profile of Contract

Drawings, at designated stations to the side of the Exploratory Tunnel, where defined geotechnical investigations will be conducted.

3. Pay Line: The theoretical excavation profile of the tunnel cross-section shown on Contract Drawings to which payment for excavation will be made and designated by the letter A.
4. Overbreak: Any excavation which extends beyond the pay line irrespective of the reason for such excavation.
5. Enlargement: Additional excavation carried out to enlarge tunnel cross-section for Contractor's convenience, which has already been excavated. The additional cross-sectional area shall not be considered as overbreak.
6. Initial Support: The support types shown on the Contract Drawings are required to be installed closely behind the advancing tunnel heading for the purpose of minimizing ground movement and loosening, and maintaining stability of the opening. Note that this is a minimum initial support required to be installed; the Contractor is required to install whatever support is necessary to provide a stable excavation.

1.3 SUBMITTALS

- A. Submittals shall conform to Special Note For Submittal Procedures.
- B. Work Plan: Submit a detailed Work Plan and schedule of all proposed tunnel construction operations, including any enlargements or additional excavations required for the Contractor's own convenience. The Work Plan shall include, but is not limited to the following:
 1. Methods, Procedures, and Schedule for Tunnel Excavation and installation of invert concrete – including details of proposed methods and procedures, equipment and machinery, construction sequencing, and progress schedules for excavating the Exploratory Tunnel and the exploration bays, and any other pertinent underground excavation work.
 2. Methods of dealing with Karstic Features – This will include general details of measures to be undertaken, including a management plan, to enable the tunnel to progress should Karstic Features, as described in the GBR, are encountered either during probe drilling operations or during tunnel excavation. When such features are encountered individual Work Plans will be required to be prepared in collaboration with the Engineer. Such plans will require to be sealed by a Professional Engineer licensed in the Commonwealth of Kentucky.
 3. Muck Removal, Disposal and Management Plan:
 - a. Submit detailed information on the handling and transport of excavated materials, including both underground and above-ground operations, and details of transport equipment and other equipment and machinery to be used. Particular attention should be given to detailing of management procedures for muck transfer area, the transfer of materials from underground transport to road transport trucks and the control of such vehicles, including traffic management procedures at site entrance, in

- transporting muck from site to designated site disposal area.
4. Where excavations are to be made larger than dimensions shown on Contract Drawings, or additional excavations are to be made, for the Contractor's own convenience, submit associated design calculations and drawings for the rock reinforcement and support of these excavations to the Engineer for review and these design calculations and drawings shall be sealed by a Professional Engineer registered in the Commonwealth of Kentucky.
- C. Reports and Records: Prepare reports of tunnel construction, work for each shift and submit the reports on the previous day's activities to the Engineer by the next morning. The following minimum information, and other required information as set in specific specifications shown in Related Sections, shall be included in these reports and the reports shall be accurate to 15 minutes and be in a format accepted by the Engineer:
1. General Shift Report:
 - a. Station of tunnel face and width and height of bench, if used, at start and end of each work shift.
 - b. Crew size; employee classification and assigned duties.
 - c. Method(s) of tunnel excavation utilized at each location.
 - d. Type, quantity, and location of initial support installed.
 - e. Initial support system measurements, including records of any observed deformation.
 - f. Survey records of tunnel excavation including the offset from design line-and-grade,
 - g. Description of the ground encountered in excavation and notes on the ground behavior. Location and elevation of significant rock strata boundaries encountered during excavation.
 - h. Identification of Work disruption s and equipment malfunction, including the station or location and time periods of each occurrence.
 - i. Duration of downtime with explanation of cause(s) for downtime.
 - j. Location and estimated volume of groundwater inflows, including method of estimation.
 - k. Location, patterns and lengths of advance probe drilling performed. Penetration log of drilling advance rate over unit time with depth along the hole. Description of cuttings returned. Location of water pressure testing performed, grouting performed, volume of grout used, and effectiveness of grout – in accordance with requirements set in Section 31 71 26 -Probe Drilling and Grouting.
 - l. Details of monitoring equipment installed or read in accordance with requirements set in Section 31 09 13 - Instrumentation and Monitoring.
 - m. List of major equipment used and respective location.
 - n. Blasting records as required in Section 31 71 16.02 - Blasting.
 - o. Air quality monitoring and ventilation records.
 - p. Locations of any exposed shale at the invert and details of invert concrete installation including locations and quantity of concrete.
 - q. Weather conditions including temperature and rainfall.
 - r. Construction loadings in the vicinity of instrumentation.
 - s. Incidence of excessive ground loss or other unusual events encountered during excavation.
 - t. Other information requested by the Engineer as necessary to evaluate or

- document the construction operations.
2. Health & Safety Reports:
 - a. Provide reports as required by public authorities and in compliance with all applicable health and safety reporting requirements. Provide a copy of each such report to the Engineer within one (1) business day following preparation.
 - b. In a form and format acceptable to the Engineer, prepare a report including all measurements and results of water monitoring and sampling with identification of results, readings and measurements that exceed established threshold levels of contamination. Include in the report, a description of measures taken to reduce levels of contamination below threshold levels and dispose of the contaminated water in accordance with all applicable federal, state and local laws and regulations.
 - D. As-Built Drawings: Submit as-built drawings for the Exploratory Tunnel, the exploration bays, and any other excavations made for the Contractor's convenience, including all installed rock reinforcement and initial supports, instrumentation and monitoring devices, and tunnel line and grade.
 - E. Supervisor Qualifications: The Contractor's proposed Supervisor on each shift shall have a minimum of five years experience in tunnel excavation by drill and blast, all in the last ten years; Submit qualifications and experience records for all Shift Supervisors.
 - F. Legal Requirements and Responsibilities: Advise the Engineer in writing of all statutory controls and regulations with which the Contractor has to comply in carrying out the Work.
- 1.4 PERFORMANCE REQUIREMENT/ QUALITY CONTROL
- A. All excavation surfaces forming the theoretical excavation profile shall be excavated using controlled smooth wall blasting techniques in accordance with Section 31 71 16.02.
- 1.5 SCHEDULE OF BID ITEMS
- A. Measurement
 1. Excavation:
 - a. The Cabinet will measure the excavation of the Exploratory Tunnel and exploration bays in the units listed in the Payment Subsection and specified on the Drawings and in the Specifications and all necessary incidentals by unit length in feet of Exploratory Tunnel or exploration bay constructed to the lines and levels shown on the Drawings irrespective of over excavation of the required final tunnel dimensions. A distinction will be made for the different classes of excavation that will be determined on the basis of the geotechnical heading logs submitted to the Engineer in accordance with the Contract. Separate items are provided for excavation requiring the various primary lining support types. The net area in place before excavation as calculated from the payment line shown on the Drawings, together with the unit length of tunnel will enable the Contractor to define the theoretical excavation

- volume for any section of tunnel.
- b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
- 1) Complying with all requirements of Acts and Regulations relating to underground work and any restrictions resulting therefore and complying with all the requirements of Health and Safety.
 - 2) All survey, setting out, preliminary checking and correcting the excavated profile, including provision and use of approved devices for this work and including any disruptions while this work is done.
 - 3) All work consumables including explosives and any labor and equipment to excavate the profile using controlled blasting techniques.
 - 4) Allowing for the maximum length of unsupported span to meet the requirements for the installation of initial rock support as well as allowing for the Contractor's assessment of any lesser length required to suit the encountered conditions.
 - 5) The installation of support will be measured and reimbursed under the applicable subsections in Section 31 72 13 - Rock Reinforcement and Support.
 - 6) The installation of probe holes and grouting operations will be measured and reimbursed under the applicable subsections in Section 31 71 26 - Probe Drilling and Grouting.
 - 7) All final checking and correcting the excavated profile prior to erecting the tunnel initial support. This shall include for all disruptions while this work is carried out as well as all consequential disruptions for work such as removing underbreak and/or replacing support.
 - 8) Water inflow into the underground work, for the range of flows itemized in Section 31 71 29 - Control and Removal of Tunnel Water.
 - 9) All loading of excavated underground material and hauling the material from the working face to the designated site stockpile (temporary stockpile). This shall include all equipment necessary for transportation on all gradients and ancillary surface equipment where necessary and transportation to final disposal area and spreading.
 - 10) Any changes in excavation method resulting from causes which are the responsibility of the Contractor.
 - 11) Any partial or short interruptions or inconveniences caused to the Work as a result of the Engineer carrying out tests, measurements, setting out checks, geological mapping or the like as detailed in the Specification.
 - 12) Measurement of the rock classes by the Contractor for payment purposes including, as appropriate, washing down of rock faces, rotary core drilling, and the like.
 - 13) No allowance for overbreak beyond the theoretical excavation

and payment line shall be eligible for compensation.

- 14) No allowance or payment for any and all enlargements required by the Contractor for equipment, conveniences, construction methods, access etc. including additional excavation, disposal of spoil, support and for random backfilling as specified.
- 15) Blasting and Vibration monitoring shall be incidental to the excavation of the Exploratory Tunnel and Exploratory Bay.

2. Rockfalls

- a. The Cabinet will measure the net volume, in the units listed in the Payment Subsection, of the void formed by a slip or fall and the “A line” given on the Drawings.
- b. Any supplemental support over and above that indicated on the drawings installed shall be measured under the appropriate payment item within Section 31 72 13.
- c. The Cabinet will measure the net volume of excavation considering cavities formed by localized rockfalls greater than 1.5 feet beyond the excavation line, defined as the “A line” on the Drawings, as agreed with the Engineer to include for the following elements:
 - 1) Mucking.
 - 2) Flowable fill concrete, grout, sprayed concrete or other backfill accepted by the Engineer.
 - 3) Formwork for concrete.
 - 4) Reinstatement or replacement of primary support.
- d. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Loading, transporting and disposing of material to site stockpile as directed including utilization and maintenance of muck transfer area in accordance with the approved Work Plan, and the backfilling of the voids with concrete, grout, sprayed concrete or other materials as directed by the Engineer. All plant, equipment and materials required reinstating or replacing any primary support elements. Installation of additional primary support elements shall be measured when instructed by the Engineer as per Section 31 72 13 - Rock Reinforcement and Support. All plant and equipment to carry out the Work and any disruption to the Work.

3. Invert Concrete

- a. The Cabinet will measure installation of invert concrete in the units listed in the Payment Subsection and as indicated on the theoretical invert excavation and payment line shown on the Drawings irrespective of the final tunnel dimensions excavated.

B. Payment

1. The Cabinet will make payment for the completed and accepted quantities under the following:

Code	Payment Item	Pay Unit
22314EN	Tunnel Portal support Type P (mandatory)	Linear foot
22315EN	Excavation requiring Support Type IV (Under US 42 –mandatory)	Linear foot
22316EN	Excavation requiring Support Type I	Linear foot
22317EN	Excavation requiring Support Type II	Linear foot
22318EN	Excavation requiring Support Type III	Linear foot
22319EN	Excavation requiring Support Type EBC	Linear foot
22320EN	Excavation requiring Support Type Karst Void	Linear foot
22321EN	Discrete rockfalls 1.5 feet beyond A line	Cubic yard
22322EN	Invert Concrete	Square foot

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. All equipment used for the Work, including but not limited to, equipment for rock drilling and blasting operations, muck removal and disposal, invert concrete, rock reinforcement and support installation, rock probing and grouting, and monitoring and instrumentation, shall be supplied by recognized manufacturers in the tunneling industry.
- B. The type of equipment to be used, in particular rock drilling equipment and accessories, shall be compatible with the dimensions of the excavation and anticipated geologic conditions described in the Geotechnical Baseline Report (GBR).
- C. Use of experimental equipment is at Contractor's own risk. Experimental equipment is defined as any equipment, which has no historical performance data for the Work to be performed. Note the scheduling constraints for this project and select equipment capable of achieving the required schedule.
- D. An inventory shall be maintained of replacement parts and accessories recommended by equipment manufacturers to ensure continued functioning of all essential tunnel construction equipment.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Safety of Work and Persons
 - 1. Safety of the Work shall comply, in addition to this Section, with the appropriate requirements of Section 01 35 00 - Safety Procedures for Tunnel Construction.
 - 2. Control of Site Entry - Establish and maintain effective systems to control access to the underground works by all persons. The systems of control used by the Contractor shall be to the approval of the Engineer. The Engineer reserves the right to withdraw such approval if he is not satisfied that the systems are being applied and controlled adequately.

- B. Tunnel Water Control
 - 1. A tunnel construction water control system shall be installed, operated, and maintained by the Contractor in accordance with Section 31 71 29 - Control and Removal of Tunnel Water and drawings. All infiltration water and water introduced for the Work shall be removed.
 - 2. Any standing water on the bottom of the excavation and any free falling water shall be maintained in a manner that shall prevent an adverse impact to the quality of the Work and the stability of the ground.
- C. Tunnel Ventilation
 - 1. Supply ventilation to work areas in sufficient quantity to comply with Section Note 01 35 00 - Safety Procedures for Tunnel Construction, and Section 01 51 00 - Tunnel Ventilation and Utilities.
- D. Noise and Dust Control
 - 1. Noise levels and dust controls shall comply with all applicable federal, state and local codes, laws, regulations and ordinances.
 - 2. Operations shall be conducted to minimize the impact of noise and dust to the residents in the vicinity of the Work. All surface equipment shall be equipped with noise suppressors and enclosed in sound attenuation enclosures. All compressors shall be enclosed in sound attenuation enclosures. All gasoline, diesel or air-powered equipment shall be equipped with silencers or mufflers on exhaust lines. Storage bins and hoppers shall be lined with materials that deaden sound.
- E. Alignment and survey Control
 - 1. Install an alignment control system in accordance with Section 01 32 23 – Tunnel Surveying.

3.2 ROCK EXCAVATION

- A. All rock excavations shall be carried out in accordance with predetermined plans, procedures and schedule as submitted and agreed to by the Engineer. Any deviations shall be submitted to the Engineer for review and approval.
- B. Controlled blasting techniques shall be used to achieve the defined tunnel and exploration bays cross-sections shown on Contract Drawings
- C. Control of Tunnel Dimensions and Geometry
 - 1. Notify the Engineer of any misalignment immediately upon discovery. Submit, within 24 hours of the discovery, an as-built survey of that section of the tunnel along with a plan to bring the section back into tolerance.
- D. Round Length - Make assessment of round length required to suit the anticipated ground conditions and no separate payment shall be made for any reduced round lengths to suit the conditions encountered.

- E. Probe Drilling and Grouting – Pre-excavation probe hole drilling and grouting, as required, shall be conducted ahead of the excavation face, as defined in Section 31 71 26 - Probe Drilling and Grouting.

3.3 INSTALLATION OF ROCK REINFORCEMENT AND INITIAL SUPPORT

- A. Rock reinforcement and initial support elements shall be provided and installed by the Contractor in accordance with Section 31 72 13 - Rock Reinforcement and Support, and Section 03 37 13 - Shotcrete
- B. Nothing contained in the Specification shall prevent the Contractor from erecting such support as he may consider necessary, including rock bolts, welded wire fabric, strapping, or structural rib support. No statement in the Specification shall be considered to relieve the Contractor from sole responsibility for the safety of the excavation, or from liability for injuries to or death of persons or damage to property.

3.4 INVERT CONCRETE

- A. Invert concrete is required wherever the exposed invert is shale. Place this concrete on a weekly cycle or more often such that the invert concrete is never more than 300ft from the heading unless otherwise agreed by the Engineer.
- B. Check and remove, prior to placing the concrete, any underbreak and clean the surface of all loose and foreign material.
- C. The concrete shall comply with the requirements of KYTC Standard Specification for Road and Bridge Construction Division 600 - Structures and Concrete, Section 601 - "Concrete".
- D. Thickness shall be a minimum of 4 inches.

3.5 MUCK REMOVAL AND DISPOSAL

- A. Excavated material shall be handled and transported in accordance with applicable federal and state safety requirements, Section 01 35 00 - Safety Procedures for Tunnel Construction and Special Note for Waste Sites.
- B. The utilization, management and maintenance procedures of the designated muck transfer area within the overall muck removal and disposal plan shall follow the submitted Work Plan as accepted by the Engineer as detailed in Subsection 1.3.B.

3.6 TUNNEL ENLARGEMENTS

- A. Tunnel enlargements beyond the defined dimensions in Contract Drawings for the Contractor's own convenience shall be agreed to by the Engineer and supported adequately during construction. Supply and place additional support required by enlarged sections for the Contractor's own convenience at no additional cost to the Cabinet. Such enlargements will not be backfilled at the completion of the Contract.

3.7 TUNNEL STATION MARKERS

- A. Maintain station markers through the entire length of the tunnel. Tunnel station markers shall have a minimum lettering of 8-inches and shall be a color to contrast with background.
- B. Markers shall be located on the same side of the wall throughout the tunnel length and shall be with respect to the centerline of the tunnel.
- C. Maximum spacing shall be 20-foot stations. Markers shall be placed at approximate eye level and away from utilities.
- D. Markers shall also be provided at each change in horizontal and vertical direction including point of tangency (PT) and point of curvature (PC).

3.8 SURVEY AND TOLERANCES

- A. Section 01 40 00 - Quality Requirements
- B. Section 01 32 23 – Tunnel Surveying
- C. Demonstrate to the Engineer that the surveyed location of the heading at 50 ft increments during excavation is within specified tolerances.
- D. Provide free access and logistical support to enable tunnel photographic survey to the heading, roof and sidewalls of the tunnel.
- E. Ensure that the survey monuments or wall brackets required for the placement, or reestablishment of automatic total stations for the optical measurement of portal face, tunnel and exploration bay instrumentation shall be established, protected and maintained to ensure instrumentation and monitoring can proceed in the approved manner.
- F. Provide access and logistical support for the construction verification surveyor to check the survey of the tunnel.
- G. In the event that tolerances are exceeded, the additional excavation and associated Work necessary to bring the alignment of the tunnel within the stated tolerances shall be at no additional cost to the Cabinet.

3.9 GEOLOGIC MAPPING

- A. For Contractor's and Engineer's geologic mapping refer to Section 02 32 13 Geotechnical Investigation in Exploratory Tunnel.

3.10 PREPARATION, SCALING AND CLEANING

- A. Maintain all tunnel surfaces and the initial support system and scale down all exposed loose rock as necessary, and in a timely manner, to ensure a safe and functional work environment.

- B. All excavated rock projecting inside the required profile lines shall be removed. The removal of such projections may be performed at any time during the progress of the Work.

END OF SECTION

SECTION 31 71 16.02

EXPLORATORY TUNNEL BLASTING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies requirements for the use of explosives and blasting in connection with rock excavation for the construction of the Exploratory Tunnel, the exploration bays and any other excavations required for the Contractor's own convenience.
- B. In general, this specification covers, but is not limited to the following:
1. Explosive materials and associated devices
 2. Transportation and storage of explosives
 3. Labor and supervision
 4. Blast design
 5. Blast limitations
 6. Test blasts
 7. Drilling and loading of blast holes
 8. Execution of rock blasting
 9. Protection of existing properties, utilities and other facilities
 10. Damage repairs due to Contractor's blasting operations
- C. Related Sections:
1. Standard Specifications Division 100 - General Provisions, Subsection 107.11 - "Use of Explosives"
 2. Special Note For Submittal Procedures
 3. Special Note For Blasting and Vibration
 4. Special Note For Incident Response Procedures
 5. Special Note For Construction Working Hours and Restrictions
 6. Section 01 35 00 Safety Procedures for Tunnel Construction
 7. Section 31 09 13 Instrumentation and Monitoring
 8. Section 31 71 16.01 Tunnel Excavation by Drill and Blast

1.2 REFERENCES

- A. Definitions
1. Peak Particle Velocity (PPV): The maximum of the three ground vibration velocities measured in the vertical, longitudinal and transverse directions. Velocity units are expressed in inches per second (ips).
 2. Air-Overpressure: Temporary changes in ambient air pressure expressed in units of psi or dB caused by blasting. .
 3. Charge-Per-Delay (W): For purposes of vibration control, any charges firing within any 8-millisecond time period are considered to have a cumulative effect on vibration and air-overpressure effects.

4. Scaled Distance: A factor describing relative vibration energy based on distance and charge-per-delay. For ground vibration control and prediction purposes, Scaled Distance (Ds) is obtained by dividing the distance of concern (D) by the square root of the charge-per-delay (W), that is, $D_s = D/(W)^{1/2}$
5. Smoothwall Blasting (Trim Blasting): A controlled blasting technique used to produce smooth perimeters of rock excavation. The holes for smoothwall blasting are located around the perimeter of the excavation with reduced spacing for regular blastholes and are loaded with low strength or decoupled charges and are fired after main charge.
6. Line Drilling: A method of controlling blast overbreak, in which a single line of closely spaced parallel holes is drilled along the limit line of the excavation. Line holes are generally not loaded with explosives; however, in some applications alternating holes may be loaded with light charges using detonating cord and are fired after the main charge.
7. Controlled Blasting: Excavation in rock in which the various elements of the blast, including hole size, position, alignment, depth, spacing, burden, charge size, distribution and delay sequence; are carefully controlled to excavate the rock to the desired lines with a relatively uniform surface; with minimal overbreak and fracturing of rock beyond the design excavation limits; and to maintain resulting noise, overpressure and peak particle velocity within specified maximum limits.
8. Production Holes: Blast holes in the main body of the rock mass being removed by drilling and blasting.
9. Stemming: Crushed stone, tamped clay or other inert material placed in the unloaded collar area of blast holes for the purpose of confining explosive charges and limiting rock movement and air-overpressure (airblast).
10. Buffer Holes: Holes with reduced energy charges drilled parallel and adjacent to smooth blasting or line-drilled holes at the perimeter of the excavation. The explosive charge in buffer holes is generally between 50 and 75 percent of the charge used in normal production blast holes.
11. Primary Initiation: The use of pneumatic tubing or shock-tubes to convey firing energy from a remote location to safely initiate controlled blasting operations.
12. Sub-drilling: The portion of the blast hole that is drilled below or beyond the desired excavation depth or limit to mitigate the occurrence of high or tight areas of unfractured rock between blast holes.
13. Surface Blasting: All excavations where surface blasting techniques are required.

14. Prohibited Persons: Persons prohibited from handling or possessing explosive materials as defined by the seven categories described in Section 555.11 of 27 CFR (ATF Rules).
15. Occupied Building: Structure on or off construction limits that is occupied by humans or livestock.
16. Residential Building: Single and family dwellings, hotels, motels and any other structure containing sleeping quarters.

B. Reference Standards

1. U.S. Department of Justice, Alcohol, Tobacco, Firearms and Explosives Division (ATF). 27 CFR Part 555, Implementation of the Safe Explosives Act, Title XI, Subtitle C of Public Law 107-296; Interim Final Rule.
2. Institute of Makers of Explosives:
 - a. Do's and Don'ts - Instructions and Warnings for Consumers in Transporting, Storing, Handling, and Using Explosive Materials.
 - b. Destruction of Commercial Explosives.
 - c. Suggested Code of Regulations for the Manufacture, Transportation, Storage, Sale, Possession and Use of Explosive Materials.
 - d. Safety in the Transportation, Storage, Handling and Use of Explosive Materials.
 - e. Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Blasting Caps.
3. National Fire Protection Association:
 - a. NFPA 495 - Code for the Manufacture, Transportation, Storage and Use of Explosive Materials, 1985 Edition.
 - b. NFPA 498 - Standard for Explosives, Motor Vehicle Terminals, 1985 Edition.
4. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), Construction Standards and Interpretations 29 CFR Part 1926, Subpart U, Section 1926.900, "Blasting and Use of Explosives", final rule dated December 16, 1972.
5. Commonwealth of Kentucky Administrative Regulations, Title 805.
6. Vibration Subcommittee of the International Society of Explosive Engineers (ISEE), blast monitoring equipment operation standards (1999).

1.3 SUBMITTALS

- A. Submittals shall conform to Special Note For Submittal Procedures.
- B. Permits: Submit a copy of all applicable permits, certifications and licenses for transportation, storage, and use of explosives to the Engineer prior to the start of blasting operations. Submitted permits must include a copy of Federal ATF blasting license listing all responsible persons, blasting use and storage permits issued by the Commonwealth of Kentucky, and any other necessary local permits. No explosives can be brought to any work sites until all necessary permits have been submitted to the Engineer.

- C. Regulations: Obtain at least two copies of all applicable federal, state and local codes, laws, regulations and ordinances regarding the use of explosives. One copy of these codes, laws, regulations and ordinances shall be submitted to the Engineer at least 14 days prior to blasting. The second copy shall be maintained on-site in the Contractor's office, for review by all Contractor personnel involved in blasting.
- D. Contractor Qualifications and Evidence of Experience: Submit resumes of proposed blasting supervisors to the Engineer. Resumes shall contain listing of experience in explosives and tunnel blasting work, project references with contact information and copies of all required blasting licenses.
- E. Blast Designs and Safety Measures: Submit to the Engineer the following information for initial test blasts and proposed production blast design for the tunnel heading:
1. Number, location, diameter, depth and orientation of drill holes on a scaled drawing of the excavation or tunnel heading face.
 2. Type of explosive and weight of charge in each hole.
 3. Type and nomenclature of detonators.
 4. Type and distribution of stemming used to fill hole collars for charge confinement.
 5. Total amount of explosives in the blast and maximum charge-per-delay.
 6. Delay arrangement showing delay period in each hole.
 7. Description of the proposed blasting system; and type of firing source.
 8. Specific measures taken to protect structures, buried utilities and other facilities, as identified in accordance with Special Note For Blasting and Vibration, that could be affected by the blasting operations.
 9. Type and methods of matting and containment of blast area to mitigate fly rock.
 10. Description of and locations of signage used to announce blast warning signals to prevent persons entering blast areas.
 11. Clearing, guarding and communication procedures to confirm that all persons are evacuated to safe areas and that blast areas are secured prior to blasting.
 12. Prediction calculations for noise (air-overpressure) and peak particle velocity (PPV) at the closest structure and at other adjacent structures, pipelines or facilities, as identified in accordance with Special Note For Blasting and Vibration that could be affected by the blasting operations.
 13. Monitoring record measurements to be taken prior to, and after blasting in accordance with Special Note For Blasting and Vibration that could be affected by the blasting operations
 14. Any redesign of the blasting program shall be submitted to the Engineer.
- F. Blasting Records: Maintain a record of each blast detonated. Submit to the Engineer the following records and information the same day the blasting is performed:
1. Depth and number of blast holes and the location of the blast point in relation to Project stationing.
 2. Type, strength and quantities of all explosives, types and quantities of detonators, powder factor (lb/cyd), and actual firing times of all charges.
 3. Total explosive loadings per round and maximum charge per delay.
 4. Type of rock blasted.
 5. Reference to approved blast design submittal noting any modification.
 6. Time spent scaling rock and approval of rock scaling by designated individual.

7. On a diagram of the approved blast pattern indicate any holes not drilled, drilled but not loaded, changes in spacing or in pattern of delay charges or in loading of holes. Include notes explaining why changes were made.
8. Submit an evaluation of the blast indicating tights, areas of significant overbreak and any recommended adjustments for future blasts.
9. Comments by the blaster in charge regarding any misfires, unusual results, or unusual effects.
10. Date and exact firing time of blast; name of person in responsible charge of loading and firing and blaster permit number.
11. Signature and title of person making recording entries.
12. Ground vibration and air-overpressure monitoring records: submit two copies of all 4-channel monitoring records
13. Deliver to the Engineer, preconstruction condition survey, containing all field notes, sketches, diagrams, photos and videos as required in Special Note For Blasting and Vibration.
14. Any other records required by federal, state and local codes, laws, regulations and ordinances.

G. Blasting Safety and Security Plans:

1. The Contractor's Safety Representative shall be responsible for ensuring that ongoing blasting work complies with all applicable regulations (also refer to Subsection 1.5.B).
2. A complete description of the clearing and guarding procedures that will be employed to ensure personnel, staff, visitors, and all other persons are at safe locations during blasting. This information shall include details regarding visible warning signs or flags, audible warning signals, method of determining blast area zones, access blocking methods, guard placement and guard release procedures, primary initiation method, and the system by which the blaster-in-charge will communicate with site safety officers.
3. Detailed description of how explosives will be safely stored, transported and used at the various work sites. Plans shall explain how storage magazines and explosive transport vehicles will satisfy all applicable regulations. This plan shall also indicate how explosives will be inventoried, secured and guarded to prevent theft or unauthorized use of explosives.
4. If overnight storage of the explosives is authorized, submit a detailed storage plan that includes scaled maps indicating proposed location of detonator and explosives that will be stored overnight, distances to nearest occupied buildings, roadways and other limiting items in the American Table of Distances.
5. Include Material Safety Data Sheets (MSDS) and specific details about hazard communication programs for employees.
6. Equipment that will be used to monitor the approach of lightning storms and in the event of such, evacuation and site safety security plans.
7. Contingency plans for handling of misfires caused by cut-offs or other causes.
8. Fire prevention plan details, including smoking policies, procedures and limitations for work involving any open flames or sparks, description and location of all fire fighting equipment, and fire fighting and evacuation plans and requirements of Special Note For Incident Response Procedures.
9. Initial and ongoing blasting and fire safety training programs.

10. Description of the personal protective equipment that will be used by the Contractor's personnel, including but not limited to, safety glasses, hard-toe footwear, hard hats and gloves.
11. Submit copies of ATF Employee Possessor questionnaire forms (OMB No. 1140-0072) or ATF letters of clearance for all employees that will possess explosives for this Work as defined in 27 CFR Part 555. Contractor employees, without submitted evidence of satisfactory ATF clearance, must not handle, control or have access to explosive materials.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver all explosives to storage magazines by land transportation in accordance with all applicable federal, state and local codes, laws, regulations and ordinances.
- B. Storage of Explosives:
 1. Transportation, use and storage of explosives shall be as prescribed by the most stringent of the rules promulgated by all federal, state and local codes, laws, regulations and ordinances, and these Specifications.
 2. Initiation devices shall not be stored, transported, or kept in the same place in which other explosives are stored, transported, or kept.
 3. Only those explosive materials required for a 24-hour period shall be allowed at the construction sites. Storage of explosives during non-blasting periods is not permitted and the day-storage magazine shall be empty during these periods unless the Contractor can obtain permits for overnight storage. If storage permits are obtained, the maximum amount of explosives must not exceed limits set by ATF rules (American Table of Distances).
 4. Provide a dedicated on-site vehicle that meets all applicable DOT, Commonwealth of Kentucky and OSHA standards regarding the transportation of explosive materials from the magazine to the blasting site. Records shall be maintained that clearly show quantities and types of all explosive materials and detonators received from suppliers and returned to them. The differences in received and returned quantities must accurately correspond with the amounts reported in blasting records.
 5. No statement in these Specifications shall be considered to relieve the Contractor from sole responsibility for the safe transportation, use and storage of explosives.

1.5 PERFORMANCE REQUIREMENTS

- A. Controlled blasting techniques shall be utilized for all drill and blast operations. Extra caution and skill will be required to accomplish the Work in a satisfactory manner. Blasting must be safely performed in close proximity to residential communities and other structures. Effects of blasting must also be controlled to maintain the integrity of the grouted rock adjacent to the tunnel excavations to minimize groundwater inflows. The Engineer will exercise prerogative to examine the qualifications of any persons whose knowledge and skills may bear on the outcome of the Work. In addition, the Engineer may reject any person who is deemed to be unqualified for any tasks that are related to the Work.
- B. Refer to Special Note for Blasting and Vibration.

- C. The design and execution of blasting shall be performed under the on-site supervision of a licensed blaster certified in the Commonwealth of Kentucky.
- D. Perform blast monitoring as required to satisfy its legal obligation relative to all permits and all applicable federal, state and local codes, laws, regulations and ordinances, and its contractual responsibilities, including safety.
- E. Perform blast monitoring, (Engineer may be present), to verify conformance with regard to air-overpressure. Perform blast monitoring, the Engineer may be present, to verify conformance with regard to peak particle velocity criteria defined by Special Note for Blasting and Vibration.
- F. Perform and record, (Engineer may be present), all primary compliance monitoring of blasting, including the test blasts. The documentation of all blasting monitoring will be provided to the Engineer within one (1) business day of each occurrence. Contractor can perform additional monitoring provided that the equipment complies with the International Society of Explosive Engineers guidelines and practices. Provide to the Engineer copies of monitoring records collected. Only qualified and trained persons shall operate seismographs on behalf of the Contractor.
- G. Qualifications and Clearance Status:
 - 1. The blasting supervisor (blaster-in-charge) shall have a minimum of 5 years experience, directly related to the specific types of excavation blasting they will oversee. All blasting supervisors shall be able to document the completion of at least three projects of similar scope and complexity.
 - 2. All blasters and supervising shift foremen shall be properly qualified and licensed in accordance with applicable federal, state and local government regulations.
 - 3. All persons that handle explosive materials, have control over them, or access to them, must not be prohibited persons, as defined in Section 555.11 of 27 CFR (ATF Rules).
 - 4. Engage the services of an experienced, independent, licensed Blasting Consultant to design, review, evaluate and modify the blasting operations.
 - 5. Engage the services of an experienced, independent, licensed Engineer to evaluate any claims that may arise from local residences and/or businesses, as a result of blasting. Submit the details of the consultants experience to the Engineer for approval at least 30 days prior to blasting commencing.

1.6 SCHEDULE OF BID ITEMS

- A. Measurement
 - 1. The Cabinet will not make separate measurement except as noted below for the Contractor's compliance with the requirements of this Section of the Specification or any inconvenience to the Work caused.
 - 2. The Cabinet will measure the provision of Vibration Monitoring Equipment as per Specification Section 31 09 13 – Instrumentation and Monitoring
- B. Payment

1. The Cabinet will not make separate payment for items associated with this Section of the Specification and will consider such items to be included in the tunnel excavation rates in Section 31 71 16.01 - Tunnel Excavation by Drill and Blast.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Only explosive and initiation devices packaged by federally-licensed explosives manufacturing firms shall be used in blasting. All explosives and blasting agents to be used underground shall meet the Fume Class I requirement of the Institute of Makers of Explosives (IME). This restriction does not apply to detonation cords that may be used for trunk lines or in controlled perimeter blasting charges.
- B. Only packaged or cartridge type, non-flowing explosives shall be used in the Work. Black powder and nitroglycerine are prohibited for all blasting.
- C. Non-electric detonating devices shall be used.
- D. Only explosives designed and manufactured for smoothwall blasting shall be used in perimeter holes for blasting in the excavations.
- E. Explosives, blasting agents, primers, initiators, and ancillary blasting materials shall be kept in original packaging with clearly marked date codes. All explosives and initiating devices used shall be less than one year old.
- F. If the Engineer determines that a blasting product appears to be in a damaged or deteriorated condition, the suspect product shall not be used until its condition can be determined. Products found to be damaged or in a deteriorated condition shall be immediately returned to the supplier for safe disposal.

2.2 BLAST MONITORING EQUIPMENT

- A. Refer to Special Note For Blasting and Vibration.

2.3 CONDITION SURVEY

- A. Refer to Special Note For Blasting and Vibration .

PART 3 EXECUTION

3.1 GENERAL BLASTING LIMITATIONS

- A. Blasting limitations shall be per requirements of Special Note For Construction Working Hours and Restrictions or otherwise as directed by the Engineer as tunnel excavation proceeds.

- B. Air-over pressure (noise) limitations are defined in Article 3.4 below.
- C. Blasting vibration should meet the requirements from Special Note for Blasting and Vibration.

3.2 WARNING SYSTEM

- A. Erect signboards of adequate size at locations agreed with the Engineer stating that blasting operations are taking place in the area, and such signs shall be clearly visible at all points of access to the area. These signs shall also clearly display the audible warning signals (horn signals) that will be used to warn all people in the area of the impending blast.
- B. An audible blast warning system shall be established, publicized, and operated only during blasting hours.
- C. Operate a system to ensure that no personnel remain underground during blasting operations and blasting operations shall not be undertaken until it can be demonstrated that all personnel are accounted for and in a safe location.

3.3 BLASTING OPERATIONS

- A. The Engineer shall be notified one (1) business day before blasting commences in the tunnel or at any specific location. After the initial notification for blasting in tunnel this 24hr requirement will not be required. Provide the Engineer with a schedule for all non-tunnel blasts and shall notify the Engineer if any blast is delayed for more than one hour. However, re-shoot missed holes and tights will be allowed, as they are uncovered without advance notice to the Engineer.
- B. Controlled blasting methods shall be used for all blasting operations within the tunnel. Drill round lengths, including sub-drilling shall be determined with the consultation of the Blasting Consultant such that over excavation will be kept to a minimum.
- C. Holes shall not be charged with explosives at the same time that drilling or other mechanized equipment not needed to charge the round is being operated within 50 feet of the blast area.
- D. The first blasting operation shall be conducted as a test case. The first test blast shall be no larger than 25 percent of the planned production design blast as measured by charge-weight-per-delay. The second and third test blasts shall be no larger than 60 and 100 percent respectively of the planned production design blast. After each test blast and review of test blasting data, the Contractor and Engineer shall meet to review the blast program. Drilling and delay patterns, amount and type of explosives to be used in subsequent production blasts shall be revised as required according to the results of the test cases. The Contractor may offer alternative test blasting procedures to the Engineer for review and approval. Blasting techniques shall be developed and improved as work progresses.

- E. Conduct ground vibration monitoring as defined in Special Note for Blasting and Vibrarion. The results of such monitoring test results will be provided to the Engineer within one (1) business day. Changes in drilling and delay patterns and amount of explosives shall be made when tests indicate vibrations and/or overpressures in excess of that specified herein. Any major changes in the production blast design shall be submitted to the Engineer.
- F. Ventilate the tunnel prior to personnel entering. After a blast is fired, all loose and shattered rock or other loose material shall be removed and the excavation made safe before proceeding with any work. Before drilling of blast holes for a new round, the heading shall be thoroughly cleaned and examined for missed holes and unexploded charges. The fact that the removal of loose or shattered rock or other loose material may enlarge the excavation beyond the required limits shall not relieve the Contractor of responsibility for such removal and subsequent additional backfill, shotcreting or concreting, and the Contractor shall not be entitled to additional payment for over-excavation or overbreak except as indicated on the Contract Drawings.
- G. No blasting is allowed within 40 feet of freshly placed concrete or grouted rock until 12 hours has elapsed since placement. Shotcrete is exempt from these requirements.
- H. All transportation of explosives on the surface or underground and any handling, blast charging or tie-in operations shall be stopped immediately upon the approach of an electrical storm, and all persons shall immediately be evacuated from the blasting area to a place of safety. Persons underground shall be notified of the approach and cessation (all clear) of an electrical storm, each by means of different signals. In tunnels or other excavation handing explosives, loading of holes, connecting up or firing of charges shall not be performed during an electrical storm and all persons shall withdraw to a safe distance from a partially or totally loaded heading. During such storms, explosives on the surface shall be left in OSHA-approved transport containers, delivery vehicles, day-storage boxes or in approved storage magazines.
- I. All light and power circuits shall be disconnected and/or removed to a point not less than 50 feet from the heading while explosives are being transported into the area and while the loading operations are taking place. During the loading operations only OSHA approved lighting may be used.

3.4 VIBRATION LIMITATIONS AND CONTROL

- A. Air blast overpressure shall not exceed 130 decibels when monitored with an instrument meeting requirements of this specification at any location. Air blast monitoring shall take place at the nearest residential or business structures susceptible to damage or claims of annoyance. Decide which properties are to be monitored. The Engineer may be present during monitoring.
- B. All measurements of blast-induced air-overpressure shall be done in accordance with the standards developed by the Vibration Section of the International Society of Explosives Engineers-1999.

- C. The maximum intensity of motion in the vertical, longitudinal and transverse directions, measured in the ground near any building or other surface structure shall not exceed the limits in Special Note for Blasting and Vibration.
- D. The minimum scaled distance to the nearest surface structure for all blasts shall be 50 feet or higher; i.e. for a blast located 100 feet from a structure, the maximum charge-per-delay shall not exceed 4 pounds; $W = (D/D_s)^2 = (100/50)^2 = 4$ lbs. The maximum charge-per-delay equals the sum of the weight of all charges firing within any 8-millisecond time period. For example, if two 10 lb. charges fire at 100 ms and one 15 lb charge fires at 105 ms, the maximum charge per delay would be 35 lbs.
- E. The maximum intensity of motion in the vertical, longitudinal and transverse directions, measured on the ground above any buried utility lines or pipes shall not exceed 2.0 inches per second at any frequency of motion.
- F. Monitor each blast with four (4) seismographs located, as approved, between the blast area and the closest structures and/or utilities. Refer to Special Note for Blasting and Vibration.
- G. All measurements of blast-induced ground motion shall be performed in accordance with the standards developed by the Vibration Section of the International Society of Explosives Engineers 1999.

3.5 SUSPENSION OF BLASTING

- A. Refer to Special Note for Blasting and Vibration for additional requirements and liquidated damages.
- B. Blasting operations may be suspended by the Engineer for any of the following reasons:
 - 1. The Contractor's safety precautions are inadequate.
 - 2. Air-blast or ground motion levels exceed specified limits.
 - 3. Existing structural conditions on and off site are aggravated and are damaged by blasting.
 - 4. Blasting causes instability of slopes or causes damage to rock outside the prescribed limits of excavation.
 - 5. The results of the blasting, accepted by the Engineer, are not satisfactory.
 - 6. Failure of the Contractor to adhere to the submitted and accepted blasts plan.
- C. Blasting operations shall not resume until the Engineer has accepted the Contractor's revised blasting plan with modifications correcting the conditions causing the suspension.

3.6 PRE-CONSTRUCTION/POST-CONSTRUCTION CONDITION SURVEYS

- A. Pre-construction and post-construction condition survey will be performed in conformance with Special Note For Blasting and Vibration.

3.7 DAMAGE REPAIR

- A. When blasting operations damage off-site properties or a portion of the Work or material surrounding or supporting the Work, promptly repair or replace damaged items to the condition that existed prior to the damage.

END OF SECTION

SECTION 31 71 23

MECHANICAL TUNNEL EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

- A. The Work specified in this Section consists of mechanical excavation of the Exploratory Tunnel and exploration bays, any enlargement of tunnel excavations, and all other pertinent activities necessary for the successful completion of the tunnel construction.
- B. Alternative mechanical excavation methods in this Section will be considered, subject to acceptance by the Engineer as stated in the GBR Subsection 7.1 Methods of Tunnel Excavation.
- C. All Work required for the construction of the Exploratory Tunnel and the exploration bays, including the installation of tunnel reinforcement and support elements, invert concrete and all other pertinent activities shall be performed in accordance with the specific sections identified in Related Sections, and requirements specified herein.
- D. The excavated dimensions of the Exploratory Tunnel and exploration bays shall be in accordance with Contract Drawings. The crown geometry, height, and line/grade of the Exploratory Tunnel and the exploration bays as shown in the Contract Drawings shall be maintained along the entire length of the alignment. Any enlargements to the tunnel sidewalls and deepening of the tunnel invert for the convenience of the Contractor's operations shall be subject to the Engineer's review and approval and shall be at the Contractor's own expense.
- E. Mechanical Tunnel Excavation shall include fabrication, transportation, testing, assembly at site, installation and launch of the tunnel excavation equipment; the excavation, handling, removal, and disposal of all materials encountered in the tunnel excavation; the installation of initial tunnel support; groundwater control; temporary drainage, tunnel ventilation, lighting, and wiring; tunnel safety; and all appurtenant work necessary to complete the Work in accordance with the Contract Documents.
- F. Select and utilize methods and equipment compatible with the selected dimensions of the tunnel and with the anticipated geologic conditions described in the Geotechnical Baseline Report (GBR).
- G. Related Sections:
 - 1. Special Note For Submittal Procedures
 - 2. Special Note For Blasting and Vibration
 - 3. Special Note For Waste Sites
 - 4. Section 01 35 00 Safety Procedures for Tunnel Construction
 - 5. Section 01 40 00 Quality Requirements
 - 6. Section 01 51 00 Tunnel Ventilation and Utilities
 - 7. Section 01 32 23 Tunnel Surveying

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| 8. | Section 02 32 13 | Geotechnical Investigation in Exploratory Tunnel |
| 9. | Section 03 37 13 | Shotcrete |
| 10. | Section 31 09 13 | Instrumentation and Monitoring |
| 11. | Section 31 71 16.01 | Tunnel Excavation by Drill and Blasting |
| 12. | Section 31 71 16.02 | Blasting |
| 13. | Section 31 71 26 | Probe Drilling and Grouting |
| 14. | Section 31 71 29 | Control and Removal of Tunnel Water |
| 15. | Section 31 72 13 | Rock Reinforcement and Initial Support |

1.2 REFERENCES

A. Definitions

1. Exploratory Tunnel: The tunnel as defined in the Contract Drawings.
2. Exploration Bays: Excavated spaces, as defined in Plan and Profile of Contract Drawings, at designated stations to the side of the Exploratory Tunnel, where defined geotechnical investigations will be conducted.
3. Pay Line: The theoretical excavation profile of the tunnel cross-section defined on Contract Drawings to which payment for excavation will be made.
4. Overbreak: Any excavation which extends beyond the pay line irrespective of the reason for such excavation.
5. Enlargement: Additional excavation carried out to enlarge tunnel cross-section for Contractor's convenience, which has already been excavated. The additional cross-sectional area shall not be considered as overbreak.
6. Initial support: The support types shown on the Drawings and required to be installed closely behind the advancing tunnel heading for the purpose of minimizing ground movement and loosening and maintaining stability of the opening.
7. Mechanical Excavation Equipment: An item of proprietary equipment specifically designed and constructed for excavating rock in an underground environment. This includes continuous excavation equipment such as roadheaders or non-continuous such as mechanical breakers.

1.3 SUBMITTALS

- A. Submittals shall conform to Special Note For Submittal Procedures.
- B. Work Plan: Submit a detailed work plan and schedule of all proposed tunnel construction operations, including any enlargements or additional excavations required for the Contractor's own convenience. The Work Plan shall include, but is not limited to the following: Submit the proposed mix with a satisfactory historical record of strengths per these Specifications.
 1. Methods, Procedures, and Schedule for Tunnel Excavation and installation of invert concrete - including details of proposed methods and procedures, equipment

- and machinery, construction sequencing, and progress schedules for excavating the Exploratory Tunnel and the exploration bays, and any other pertinent underground excavation work.
2. Methods of dealing with Karstic Features – This will include general details of measures to be undertaken, including a management plan, to enable the tunnel to progress should Karstic Features, as described in the GBR, are encountered either during probe drilling operations or during tunnel excavation. When such features are encountered individual work plans will be required to be prepared in collaboration with the Engineer. Such plans will require to be sealed by a Professional Engineer licensed in the Commonwealth of Kentucky.
 3. Muck Removal, Disposal and Management Plan:
 - a. Submit detailed information on the handling and transport of excavated materials, including both underground and above-ground operations, and details of transport equipment and other equipment and machinery to be used. Particular attention should be given to detailing of management procedures for muck transfer area, the transfer of materials from underground transport to road transport trucks and the control of such vehicles, including traffic management procedures at site entrance, in transporting muck from site to designated site disposal area.
 4. Where excavations are to be made larger than dimensions shown on Contract Drawings, or additional excavations are to be made, for the Contractor's own convenience, submit associated design calculations and drawings for the rock reinforcement and support of these excavations to the Engineer for review and these design calculations and drawings shall be sealed by a Professional Engineer registered in the Commonwealth of Kentucky.
 5. Dust Suppression and Capture Plan: Submit temporary ventilation provisions and details for control and capture of dust and airborne particulates.
 6. Product Data. Submit Product Data for the tunnel excavation equipment information including the equipment manufacturer, model number, and the following information. Additional information to be provided in submittal shall include:
 - a. Manufacturer's technical specifications and working drawings, including design, dimensions, method of operation, cutterhead, cutter type, size and arrangement of cutters and picks, machine power requirements, and maintenance requirements.
 - b. Description of tunneling equipment features designed or selected to be compatible with the expected rock mass and groundwater conditions including: cutterhead design, torque, rotation speed and reversibility and cutterhead boom design, power requirements and thrust capacity.
 - c. Description of features designed or selected to be compatible with expected site restrictions, including machine track system, boom and boom base rotation ranges and clearance requirements, and cutting capacities corresponding to these cutter positions.
 - d. The manufacturer's product information, machine details and working arrangement drawings, specifications, operating procedures, and other data pertinent to the performance of the roadheader for the anticipated rock mass and ground water conditions.

- e. Description of the muck handling system, lighting and ventilation systems, probe drilling and proposed water control and monitoring provisions.
 - f. Description and drawings for arrangement of dust control system, continuous gas monitoring system, safety systems, air quality monitoring system, and other ancillary equipment.
 - g. Temporary and back-up power systems.
 - h. Description of procedures for roadheader demobilization and removal from the tunnel.
 - i. Schedule of consumable and spare parts to be maintained onsite, shipment of the road header ancillary and back up equipment to the site and other information requested by the Engineer
 - j. Used roadheader: In addition to the information required herein, for a proposed used roadheader, submit the following additional information:
 - 1) The year originally fabricated and released for operation and the name of current owner, with location, phone number, and contact person.
 - 2) The experience record of the proposed roadheader including the project names, excavated diameter, total operated hours, utilization, and rebuild records of major components.
 - 3) Machine manufacturer or re-builder certifications for the boom and cutting head; drive train, including motors, clutches, gear boxes and other components; bearings and bearing seals; hydraulic system, including pumps, pistons, cylinders, seals, and other components; electrical system; and muck removal system including conveyor and loader arms.
- C. Reports and Records: Prepare reports of tunnel construction work for each shift and submit the reports on the previous day's activities to the Engineer by 9:00AM the next morning. The following minimum information, and other required information as set in specific specifications shown in Related Sections, shall be included in these reports and the reports shall be accurate to 15 minutes and be in a format accepted by the Engineer:
- 1. General Shift Report:
 - a. Location of tunnel heading by station at start and end of each work shift.
 - b. Crew size; employee classification and assigned duties.
 - c. Method(s) of tunnel excavation utilized at each location.
 - d. Type, quantity, and location of initial support installed.
 - e. Initial support system measurements, including records of any observed deformation.
 - f. Survey records of tunnel excavation including the offset from design line-and-grade,
 - g. Description of the ground encountered in excavation and notes on the ground behavior.
 - h. Identification of work delays and equipment malfunction, including the station or location and time periods of each occurrence.
 - i. Duration of downtime with explanation of cause(s) for downtime.
 - j. Location and estimated volume of groundwater inflows, including method of estimation.

- k. Location, patterns and lengths of advance probe drilling performed. Location of grouting performed, volume of grout used, and effectiveness of grout – in accordance with requirements set in Section 31 71 26 - Probe Drilling and Grouting.
 - l. Details of monitoring equipment installed or read in accordance with requirements set in Section 31 09 13 - Instrumentation and Monitoring
 - m. List of major equipment used and respective location.
 - n. Excavation Shift Report: Prepare a shift report for each shift in which the mechanical excavation equipment was operating, which shall further contain the following information:
 - 1) Performance information and Machine operational data; including location of the tunnel heading at the point of operation at the start and end of each work shift, shift utilization and cutting rates.
 - 2) Maintenance records; including scheduled maintenance undertaken and consumables used.
 - 3) Jobsite and machine delays; including power supply, equipment downtime, ventilation and dust extractor, muck removal, staff breaks, industrial action and others.
 - o. Excavation records including details of breakdowns, maintenance etc.
 - p. Air quality monitoring and ventilation records.
 - q. Locations of any exposed shale at the invert and details of invert concrete installation including locations and quantity of concrete.
 - r. Other information requested by the Engineer as necessary to evaluate or document the construction operations.
2. Health & Safety Reports:
- a. Provide reports as required by public authorities and in compliance with all applicable health and safety reporting requirements. Provide a copy of each such report to the Engineer within 24 hours following preparation.
 - b. In a form and format acceptable to the Engineer, prepare a report including all measurements and results of air, water and excavated materials monitoring and sampling with identification of results, readings and measurements that exceed established threshold levels of contamination. Include in the report, a description of measures taken to reduce levels of contamination below threshold levels and dispose of the contaminated water, materials or gases in accordance with all applicable federal, state and local laws and regulations.
- D. As-Built Drawings: Submit as-built drawings for the Exploratory Tunnel, the exploration bays, and any other excavations made for the Contractor's convenience, all installed rock reinforcement and initial supports, instrumentation and monitoring devices, and tunnel line and grade.
- E. Supervisor Qualifications: The Contractor's proposed Supervisor on each shift shall have a minimum of five (5) years experience in mechanical tunnel excavation, all in the last ten (10) years; Submit qualifications and experience records for all Shift Supervisors.

- F. Legal Requirements and Responsibilities: Advise the Engineer in writing of all statutory controls and regulations with which the Contractor has to comply in carrying out the Work.

1.4 SCHEDULE OF BID ITEMS

- A. Measurement
 - 1. The Cabinet will not make separate measurement for the Contractor's compliance with the requirements of this section of the Specification.
- B. Payment
 - 1. The Cabinet will not make separate payment for items associated with this Section of the Specification and will consider such items to be included in the tunnel excavation rates in Section 31 71 16.01 - Tunnel Excavation by Drill and Blast.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. All equipment used for the Work, including but not limited to, equipment for excavation, muck removal and disposal, invert concrete, rock reinforcement and support installation, rock probing and grouting, and monitoring and instrumentation, shall be supplied by recognized manufacturers in the tunneling industry.
- B. The type of equipment to be used, in particular excavation equipment and accessories, shall be compatible with the dimensions of the excavation and anticipated geologic conditions described in the Geotechnical Baseline Report (GBR).
- C. Use of experimental equipment is at Contractor's own risk. Experimental equipment is defined as any equipment, which has no historical performance data for the Work to be performed. Note the scheduling constraints for this project and select equipment capable of achieving the required schedule.
- D. An inventory shall be maintained of replacement parts and accessories recommended by equipment manufacturers to ensure continued functioning of all essential tunnel construction equipment.
- E. Roadheader: The roadheader shall be a purpose-built roadheader built or rebuilt by an established roadheader manufacturer with at least 10 years experience manufacturing or rebuilding roadheaders. The roadheader shall have the following specific characteristics, capabilities and equipment:
 - 1. Configured to excavate and place Initial Support to the dimensions indicated on the Drawings, and designed to advance through all anticipated ground conditions described in the Geotechnical Baseline Report.
 - 2. The roadheader and cutter head shall be a production model with a proven track record of successful operation in comparable rock conditions. The number and pattern of picks and the cutter motion shall be of a design that enhances cutter

- efficiency while operating at a low speed under high torque. Cutterhead speeds shall be approximately 5 fps.
3. As means of preventing incentive sparks during the cutting operation, cooling the picks and suppressing dust at the bit tip, the cutter unit shall incorporate an integrated high-pressure pick flushing system with an operating pressure of approximately 400 psi.
 4. The cutter head motor, transmission and gearbox shall be of a robust design. The size of the cutter motor shall be approximately 400 horsepower with an output torque of 9.5×10^7 lb-ft.
 5. The reach of the cutter boom shall be of a design that minimizes the number of passes required to achieve the tunnel cross sectional profile shown on the contract drawings and preferably be of a telescopic type.
 6. The turret supporting the boom and the boom itself shall be of a design that has a built-in stabilization system that facilitates low vibration cutting.
 7. The machine traction shall include: Crawler tracks each individually driven and capable of maneuvering the roadheader at the heading of excavation. Tracks shall be of sufficient width to ensure positive traction under working conditions. A hydraulic-powered traction drives with easy access to the gearboxes, hydraulic motors, and chain tensioning cylinders to facilitate maintenance.
 8. The cutting control system shall be semi-automated with the facility to set restrictions on manual cutting. Such restrictions shall include, but not limited to, confining the manual cutting profile to the limits of the tunnel profile.
 9. A full color graphic LCD screen located inside the driver's cabin and used for visualizing the cutting process shall support the cutting control system. The minimum information to be displayed on the screen shall be, the cutter head position, the cutter motor current, the sump-in depth and all fault messages.
 10. Ability to excavate in rock with a range of unconfined compressive strengths as described in the Geotechnical Baseline Report.
 11. Ability to cope with sustained localized ground water inflows into the heading as described in the GBR.
 12. Ability to steer roadheader and control boom to maintain line and grade within the specified tolerances while progressing around horizontal and vertical curves, and erecting Initial Supports.
 13. Provisions for erection and installation of Initial Supports.
 14. Roadheader shall be equipped with suitable safety systems in accordance with applicable OSHA requirements for underground construction equipment, including equipment classified as a "Rapid Excavation Machine." Prior to use on this project, all roadheader electrical systems shall be configured and approved for Class I Division 2, in accordance with OSHA requirements.
 15. A power interruption system that will automatically shut down power to the roadheader upon detection of excess levels of noxious or flammable gases or of fire, and a fire suppression system.
 16. All gauges monitoring roadheader parameters shall be accessible to allow the Engineer to check readings during excavation.
 17. Maintain an inventory of spare parts and wear items recommended by the roadheader and to ensure continued functioning of roadheader and all essential systems.

PART 3 EXECUTION

3.1 GENERAL

A. Safety of Work and Persons

1. Safety of the Work shall comply, in addition to this Section, with the appropriate requirements of Section 01 35 00 - Safety Procedures for Tunnel Construction.
2. Control of Site Entry – Establish and maintain effective systems to control access to the underground works by all persons. Use systems of control accepted by the Engineer. The Engineer reserves the right to withdraw such approval if he is not satisfied that the systems are being applied and controlled adequately.

B. Tunnel Water Control

1. Install, operate, and maintain a tunnel construction water control system in accordance with Section 31 71 29 - Control and Removal of Tunnel Water and drawings. All infiltration water and water introduced for the Work shall be removed.
2. Any standing water on the bottom of the excavation and any free falling water shall be maintained in a manner that shall prevent an adverse impact to the quality of the Work and the stability of the ground.

C. Tunnel Ventilation

1. Supply ventilation to work areas in sufficient quantity to comply with Section 01 35 00 - Safety Procedures for Tunnel Construction, and Section 01 51 00 - Tunnel Ventilation and Utilities.

D. Noise and Dust Control

1. Noise levels and dust controls shall comply with all applicable federal, state and local codes, laws, regulations and ordinances.
2. Operations shall be conducted to minimize the impact of noise and dust to the residents in the vicinity of the Work. All surface equipment shall be equipped with noise suppressors and enclosed in sound attenuation enclosures. All compressors shall be enclosed in sound attenuation enclosures. All gasoline, diesel or air-powered equipment shall be equipped with silencers or mufflers on exhaust lines. Storage bins and hoppers shall be lined with materials that deaden sound.

E. Alignment and Survey Control

1. Install an alignment control system in accordance with Section 01 32 23 - Tunnel Surveying.

3.2 ROCK EXCAVATION

- A. All rock excavations shall be carried out in accordance with predetermined plans, procedures and schedule as submitted and agreed to by the Engineer. Any deviations shall be submitted to the Engineer for review and approval.
- B. Control of Tunnel Dimensions and Geometry - Notify the Engineer of any misalignment immediately upon discovery. Submit, within one week of the discovery, an as-built

survey of that section of the tunnel along with a plan to bring the section back into tolerance.

- C. Advance Length - Make assessment of advance length required to suit the anticipated ground conditions and no separate payment shall be made for any reduced advance lengths to suit the conditions encountered.
- D. Probe Drilling and Grouting – Pre-excavation probe hole drilling and grouting, as required, shall be conducted ahead of the excavation heading, as defined in Section 31 71 26 - Probe Drilling and Grouting.

3.3 INSTALLATION OF ROCK REINFORCEMENT AND INITIAL SUPPORT

- A. Provide and Install rock reinforcement and initial support elements in accordance with Section 31 72 13 - Rock Reinforcement and Support, and Section 03 37 13 – Shotcrete.
- B. Nothing contained in the Specification shall prevent the Contractor from erecting such support as he may consider necessary, including rock bolts, welded wire fabric, strapping, or structural rib support. No statement in the Specification shall be considered to relieve the Contractor from sole responsibility for the safety of the excavation, or from liability for injuries to or death of persons or damage to property.
- C. Note that the support types shown on the Drawings are minimum initial supports required to be installed; Install whatever support is necessary to provide a stable excavation.

3.4 INVERT CONCRETE

- A. Invert concrete is required wherever the exposed invert is shale. Place this concrete on a weekly cycle or more often such that the invert concrete is never more than 300ft from the heading unless otherwise agreed by the Engineer.
- B. Check and remove prior to placing the concrete any underbreak and clean the surface of all loose and foreign material.
- C. The concrete shall comply with the requirements of Standard Specifications, Division 600 - Structures and Concrete, Section 601 - “Concrete”.
- D. Thickness shall be as shown on the Contract Drawings.

3.5 MUCK REMOVAL AND DISPOSAL

- A. Excavated material shall be handled and transported in accordance with applicable federal and state safety requirements, Section 01 35 00 - Safety Procedures for Tunnel Construction and Special Note For Waste Sites.
- B. The utilization, management and maintenance procedures of the designated muck transfer area within the overall muck removal and disposal plan shall follow the submitted Work Plan as accepted by the Engineer as detailed in Subsection 1.3.B.

3.6 TUNNEL ENLARGEMENTS

- A. Tunnel enlargements beyond the defined dimensions in Contract Drawings for the Contractor's own convenience shall be agreed with the Engineer and supported adequately during construction. Supply additional support required by enlarged sections for the Contractor's own convenience and at to no additional cost to the Cabinet. Such enlargements will not be backfilled at the completion of the Contract.

3.7 TUNNEL STATION MARKERS

- A. Maintain station markers through the entire length of the tunnel. Tunnel station markers shall have a minimum lettering of 8-inches and shall be a color to contrast with background.
- B. Markers shall be located on the same side of the wall throughout the tunnel length and shall be with respect to the centerline of the tunnel.
- C. Maximum spacing shall be 50-foot stations. Markers shall be placed at approximate eye level near the spring line and away from utilities.
- D. Markers shall also be provided at each change in horizontal and vertical direction including point of tangency (PT) and point of curvature (PC).

3.8 SURVEY AND TOLERANCES

- A. Section 01 40 00 - Quality Requirements
- B. Section 01 32 23 – Tunnel Survey
- C. Demonstrate to the Engineer that the surveyed location of the heading at 50 ft increments during excavation is within specified tolerances.
- D. Provide access and logistical support for the construction verification surveyor to check the survey of the tunnel.
- E. In the event that tolerances are exceeded, the additional excavation and associated work necessary to bring the alignment of the tunnel within the stated tolerances shall be at no additional cost to the Cabinet.

3.9 GEOLOGIC MAPPING

- A. For Contractor's and Engineer's geologic mapping refer to Section 02 32 13 Geotechnical Investigation in Exploratory Tunnel.

3.10 PREPARATION, SCALING AND CLEANING

- A. Maintain all tunnel surfaces and the initial support system and scale down all exposed loose rock as necessary, and in a timely manner, to ensure a safe and functional work environment.

- B. All excavated rock projecting inside the required profile lines shall be removed. The removal of such projections may be performed at any time during the progress of the Work.

END SECTION

SECTION 31 71 26

PROBE DRILLING AND GROUTING

PART 1 GENERAL

1.1 SUMMARY

- A. The Work specified in this Section includes probe hole drilling prior to tunnel excavation as shown on Contract Drawings and pre-excavation and post-excavation grouting of the rock mass within the tunnel. This Section also specifies requirements for the development of grout mixtures for the grouting.
- B. Probe hole drilling as specified herein is to detect cavities and groundwater conditions in the rock mass ahead of the tunnel excavation. The typical pattern and frequency of probe hole drilling are shown on the Contract Drawings.
- C. Pre-excavation grouting as specified herein is to control groundwater inflows, and/or improve the stability of the rock mass by injecting grout into probe and grout holes drilled prior to excavation of the tunnel.
- D. Post-excavation grouting as specified herein is to control groundwater inflows into any part of the excavated tunnel behind the tunnel heading in the event that groundwater inflow occurs.
- E. The amount of grouting required will be determined by the conditions encountered as the excavation progresses. Perform drilling and grouting as specified herein, at such locations, at such times, and in such quantities as determined necessary.
- F. The number, spacing and depth of the holes, the inclination of the holes, and the grout pressures and volumes and grout mixes to be used will depend upon the nature of the rock as disclosed by the excavation, the results of the water inflow or other tests, and the results of actual grouting operations.
- G. Develop grouting program in accordance with the Specifications and submit to the Engineer for review prior to commencement of operations.
- H. Related Sections:
 - 1. Section 01 40 00 Quality Requirements
 - 2. Section 31 71 29 Control and Removal of Tunnel Water

1.2 REFERENCES

- A. Definitions
 - 1. Pre-excavation Grouting: Injection of grout into holes drilled ahead of the tunnel heading to decrease rock permeability and/or improve ground stability.
 - 2. Post-excavation Grouting: Injection of grout into holes drilled within the

excavated tunnel behind the tunnel heading to decrease rock permeability and/or improve ground stability.

3. Stage: A partial or complete depth of grout hole within the grout zone.
4. Refusal: The point at which grouting is stopped on a grout hole. It may be defined by the following parameters:
 - a. A maximum grout volume;
 - b. A maximum grout pressure;
 - c. A Grout Intensity Number (GIN). The GIN is a constant value for a given grouting operation and is computed as the product of the grout pressure and the grout volume at any stage during the grouting procedure ($GIN = p \times V$).
5. Split Spacing Method: The procedure of drilling and grouting an additional grout hole midway between two previously drilled and grouted holes.
6. Stage Grouting: Drilling and grouting a hole to a partial depth of cover, re-drilling the hole after the grout has set, drilling to the bottom of the next stage, and repeating the cycle until the full cover depth is reached.
7. Primary Holes: The first set of grout holes drilled and grouted.
8. Secondary, Tertiary and Quaternary Holes: Subsequent sets of grout holes drilled and grouted.
9. Long Probe Hole: An exploratory hole drilled ahead of the excavation heading to determine ground and groundwater infiltration conditions. If grouting is required, the probe hole can be used as a grout hole.
10. Short Probe Hole: An exploratory hole that is less than 20 ft long, drilled ahead of the excavation heading to determine ground and groundwater infiltration conditions. If grouting is required, the probe hole can be used as a grout hole.
11. Verification Holes: Holes drilled on the perimeter of the heading to five feet less than the length of the grouted zone after the grouting has been completed, to determine the effectiveness of the grouting performed through this area.
12. Exploration Probe Hole: An exploration hole drilled from within tunnel remote from the excavation heading to investigate the environs of the Exploratory Tunnel as detailed on the Drawings or as directed by the Engineer and undertaken using the same equipment and methods specified herein.
13. Exploration Probe Hole Setup: Setup for exploration probe holes consist of establishing the necessary drilling equipment / plant to successfully perform drilling operations for a full array of exploration probe holes as specified by the Engineer.

14. Standpipe: A length of pipe that is grouted into the collar of the probe/grout hole and used to control water inflow and contain grout in the hole.
15. Packer: A length of pipe that is mechanically sealed and anchored into the collar of the probe/grout hole and is used to control water inflow and to contain grout in the hole.
16. Grout Hole Identification: The development of a system to identify the type of grouting and location of each grout hole on the surface or in the tunnel, including both station and location around the circumference of the tunnel and hole direction and inclination.

B. Reference Standards

1. American Society for Testing and Materials:
 - a. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch Cube Specimens).
 - b. ASTM C117 - Test Method for Material Finer than 75- μm (No. 200) Sieve in Mineral Aggregates by Washing.
 - c. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
 - d. ASTM C150 - Specification for Portland Cement.
 - e. ASTM C191 - Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 - f. ASTM C204 - Test Method for Fineness of Portland Cement by Air Permeability Apparatus.
 - g. ASTM C494 - Specification for Chemical Admixtures for Concrete.
 - h. ASTM C618 - Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - i. ASTM C940-98 - Test Method for Bleeding of Cement Pastes and Mortars.
 - j. ASTM C989 - Specification for Ground Iron Blast-Furnace Slag for use in Concrete and Mortars.
 - k. ASTM C1240 - Standard Specifications for Silica Fume for Use in Hydraulic-Cement Concrete and Mortar.

1.3 QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements
- B. The Contractor's lead grouting supervisor shall be competent in grouting and shall submit evidence of at least five (5) years of experience on similar type projects. All of the Contractor's grouting Work shall be under the direct field supervision of this supervisor. Assign a qualified grouting specialist or grouting foreman to each shift that grouting operations are being conducted. Submit evidence that each grouting foreman has at least five (5) years of experience on similar type projects.
- C. The grouting supervisor shall direct the performance of the Work of the Contractor's personnel in compliance with these Specifications. If an experienced grouting supervisor and/or grouting foreman, acceptable to the Engineer, is not assigned from the

Contractor's staff, the Engineer will require the Contractor to acquire such experienced personnel or Subcontract the Work to a qualified firm specializing in grouting.

- D. Engage the services of a grouting consultant who is an expert in the development of grouting methods, grout plant design, and grout mix design for pre-excavation grouting. The expert shall have at least five (5) years recent experience in the use of ultra-fine cement grouts in advance of rock excavation in tunnels. The expert shall be available to assist in the development of pre-excavation grouting procedures, mixes and equipment, and as requested by the Engineer. The expert shall also be required to periodically review the grouting results with the Contractor and the Engineer and make recommendations for modifications to the program as necessary.

1.4 SUBMITTALS

- A. Submittals shall conform to Special Note For Submittal Procedures. The following documentation shall be submitted to the Engineer, for approval, at least 30 days before probing, drilling or grouting operations commence:
1. Submit Working Drawings and Work procedures for probe hole drilling and pre-excavation drilling and grouting of the ground ahead of the tunnel heading. Working Drawings shall show the layout and lengths of grout holes. Submit a grout plan, including grout mixes and placement procedures, including the connection details, and sequencing for pre-excavation grouting. Once grout holes have been drilled, submit Working Drawings showing as-built hole locations for each pre-excavation grouting location.
 2. Submit details of proposed grouting facilities, including but not limited to:
 - a. Grouting equipment,
 - b. Grout pressure monitoring systems;
 - c. Methods and equipment for determining quantities of grout injected and rate of grout injection;
 - d. Details of packers to be used; and
 - e. Certification of master pressure gauge calibration and calibration records for gauges and meters to be used in grouting operations prior to their use.
 3. Resubmit as appropriate if the system is modified during the course of the Work.
 4. Design of the grout mix, sequence of injection, and refusal criteria for each pre-excavation grouting operation shall be submitted to the Engineer for review.
 5. Submit description of flow measuring equipment and procedures proposed for monitoring water inflow during drilling to determine requirements for pre-excavation grouting.
- B. The following documentation shall be submitted to the Engineer on completion of each drilling or grouting operation:
1. Submit a log for each probe or grout hole drilled in a format accepted by the Engineer. The record sheets shall be completed by suitably qualified and experienced geotechnical personnel. Develop a unique numbering system for the probe and grout hole-drilling operations. In addition a graphical plot of water inflow along the length of the probe or grout hole shall be provided. Submit a record sheet to the Engineer with a minimum of the following information immediately upon completion of drilling:
 2. Date and time of drilling operation

- a. Name of drillers
 - b. Unique hole identification number
 - c. Station of collar of hole
 - d. Station of tunnel heading at time of drilling
 - e. Hole diameter and length of drilled hole
 - f. Inclination and direction of drill hole
 - g. Clock position of hole on perimeter of excavation
 - h. Type and identification of bit used, and make of drilling rig
 - i. Drilling time for each drill rod and penetration rate for each rod
 - j. Any disruption exceeding 15 minutes during drilling operations and the reason for the disruption
 - k. The location, nature, quantity and pressure of any water inflows into the holes
 - l. The color of flushing water returns both during drilling and upon completion and the location and extent of any probable changes in strata type
 - m. Details of rock cuttings recovered during the drilling operation
 - n. Results of gas testing
 - o. Thrust and torque on drill
 - p. Locations of changes in the drilling rate
 - q. Groundwater pressure at completion of drilling
 - r. Results of Water Pressure Tests undertaken for probe holes and in grout holes where directed by the Engineer.
3. Submit a log for each hole grouted in a format accepted by the Engineer. Submit a record sheet to the Engineer with a minimum of the following information immediately upon completion of grouting:
- a. Date and time of grouting operation
 - b. Name of grouters
 - c. Unique hole identification number
 - d. Station of collar of hole
 - e. Station of tunnel heading at time of grouting
 - f. Hole diameter and length of drilled hole
 - g. Clock position of hole on perimeter of excavation
 - h. For each grout stage the following information: depth of packer in hole, grout mix used as defined by water/cement ratio, additives used, pressure at point of injection at start and end of grouting operation, pressure at grout pump at start and end of grouting, weight and type of cement used, volume of grout pumped.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials shall be transported, stored and placed in a manner prescribed by the manufacturers of these materials. The materials shall be protected from mechanical damage and damage caused by environmental exposure. Spills shall be cleaned up as prescribed by the manufacturer.
- B. Cement shall be furnished in bags or in bulk. Bagged cement shall be used in the chronological order in which it was delivered to the Project. Each shipment of sacked cement shall be stored so that it may be distinguished from other shipments. Cement

shall be free from exposure and lumps due to warehouse set. If cement is found to contain lumps or foreign matter of a nature and in amounts deleterious to the grouting operations, it shall be wasted. Cement shall be passed through a fly screen before entering the mixer to remove lumps and foreign material. When bag cement is used, the empty paper bags shall be disposed of in a satisfactory manner. If bulk cement is used it shall be measured by accurate devices.

- C. Post legible copies of Material Safety Data Sheets (MSDS) and warnings as appropriate at all locations where potentially hazardous grout materials are stored or handled. Where MSDS sheets cannot be posted and maintained in tunnel, advise personnel of potential hazards of grout materials and ensure that all relevant details are contained in his Health and Safety Plan. Copies of all MSDS sheets shall be submitted to the Engineer for information only.

1.6 SCHEDULE OF BID ITEMS

A. Measurement

- 1. The following general principles of measurement and payment shall be applied to probe drilling and grouting operations and all necessary incidentals:
 - a. Those drilling and grouting operations that directly disrupt the advance of the working heading shall be reimbursed as two elements: an operation rate, for the direct work related costs; and a time rate, for the cost of disrupting the advance of the heading. Pay for this shall be applied to operations carried out under this Section of the Specifications,
 - b. Those operations that do not directly disrupt the advance of the working heading shall be reimbursed for the cost of carrying out the Work alone i.e. no separate payment shall be made in respect of standing time under Subsection 1.6 A 5.
- 2. Probing:
 - a. Routine Probing:
 - 1) The Cabinet will measure probe drilling by the units listed in the Payment Subsection, of the heading that the probe hole or holes provide information for irrespective of the number of probes required to be drilled.
 - 2) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Drilling of probe holes, by rotary percussive means, forward of the tunnel heading, to the pattern and lengths indicated on the Drawings.
 - b) All work to set up the equipment, drilling of a hole or holes dependant upon the requirements of the Specification at any angle to the depth required to achieve the specified coverage and hole overlaps, dismantling and moving of equipment to other holes as required. All variations in the strata passed through; all work, materials, and consumables; removal of flushing water; and monitoring equipment as defined in the Contract Documents.

- c) Setup for where long probe holes coincide with short probe holes shall be deemed as a single setup.
 - b. Instructed Additional Probing:
 - 1) The Cabinet will measure directed additional probe drilling by the length of hole drilled in linear feet. This will only be paid when additional probes are directed by the Engineer.
 - 2) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Drilling of probe holes, by rotary percussive means, forward of the tunnel heading, to the pattern and lengths as directed by the Engineer.
 - b) All work to set up the equipment, drilling of holes at any angle to the depth required to achieve the specified coverage and hole overlaps, dismantling and moving of equipment to other holes as required. All variations in the strata passed through; all work, materials, and consumables; removal of flushing water; and monitoring equipment as defined in the Contract Documents.
 3. Drilling for Pre-excavation Grouting:
 - a. The Cabinet will measure grout hole drilling by the length of hole drilled in the units listed in the Payment Subsection. Distinction will be made between drilled holes of different depth intervals.
 - b. The Cabinet will measure re-drilling of a completely filled hole after completion of a grout pattern or drilling of grout when instructed by the Engineer.
 - c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) The Cabinet will not measure the re-drilling of grouted materials for deepening of a grout hole prior to completion of a grout pattern or drilling of grout encountered in interconnected holes and will consider it incidental to this item of the Work.
 - 2) Rotary percussive drilling of grout holes, to the pattern and lengths indicated on the Drawings or as directed by the Engineer.
 - 3) All work to set up the equipment, drilling of grout holes at any angle to the depth required to achieve the specified coverage and hole overlaps, dismantling and moving of equipment to other holes as required. All variations in the strata passed through; all work, materials, and consumables; washing of drill cuttings; removal of flushing water; and monitoring equipment as defined in the Contract Documents.
 4. Drilling of Test Holes:
 - a. The Cabinet will measure the drilling of test holes by the length drilled in the units listed in the Payment Subsection, to the pattern and lengths indicated on the Drawings, or as directed by the Engineer. Distinction will be made between drilled holes of different depth intervals.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) All work to set up the equipment, drilling of holes at any angle to

the depth required to achieve the specified coverage and hole overlaps, dismantling and moving of equipment to other holes as required. All variations in the strata passed through; all work, materials, and consumables; washing of drill cuttings; removal of flushing water; abbreviated water pressure tests irrespective of the number of stages tested; and monitoring equipment as defined in the Contract Documents.

5. Setup

- a. The Cabinet will measure the initial setup for drilling or grouting operations carried out in accordance with Subsections 1.6 A 2, 1.6 A 3, 1.6 A 4, and 1.6 A 5 by the units listed in the Payment Subsection.
- b. Setup will be measured for each time a set of probe holes, or a set of grout holes, are drilled for probing or fissure grouting when all work connected with the routine operations of excavation advancement is suspended.
- c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) All standing time of equipment and labor normally employed solely for the advance of the working tunnel heading during these operations. No allowance shall be made for plant, equipment or labor used commonly for carrying out operations associated with the drilling and grouting defined in Section 31 71 26 - Probe Drilling and Grouting of the Specifications.

6. Grouting

- a. The Cabinet will measure the grouting of drill holes required for pre-excavation grouting, as indicated from forward probing holes through the tunnel heading, or as directed by the Engineer, the grouting of probe holes and the grouting of core or other test holes where directed by the Engineer. Measurement will be by the units listed in the Payment Subsection.
- b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) All work, including materials and equipment required to set up and grout each hole, irrespective of the number of stages grouted, for stemming of holes and for cleaning up on completion. The rate shall apply irrespective of the grout type and mix used.

7. Water pressure testing

- a. The Cabinet will measure water pressure testing by the units listed in the Payment Subsection.
- b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) All work, including materials and equipment required to set up test and seal each probe hole

B. Payment

1. The Cabinet will make payment for the completed and accepted quantities under the following:

Code	Payment Item	Pay Unit
22329NN	Routine or Instructed Additional Probe Drilling, setup	Each
22330NN	Routine or Instructed Additional Probe Grouting, setup	Each
22331EN	Probe hole drilling, Total Length >0 to 20 ft	Linear foot
22332EN	Probe hole drilling, Total Length >20 to 100 ft	Linear foot
22333EN	Probe hole drilling, Total Length >100 to 150 ft	Linear foot
22334EN	Probe hole grouting (assume tight holes)	Ton
22335NN	Grout hole drilling, setup	Each
22336EN	Grout hole drilling, drilling	Linear foot
22337NN	Grout hole grouting, setup	Each
22338EN	Grout hole grouting, grout	Ton
22339NN	Water pressure test holes per hour, setup	Each

PART 2 PRODUCTS

2.1 GROUT PIPES AND CONNECTIONS

- A. Provide grout holes complete with grout pipes, packers and grout hoses at locations as specified on the Contract Drawings. All embedded pipe, pipe wrappings and plugs shall be strong enough to withstand the grouting operations.
- B. Pipe shall be 1-3/4-inches minimum inside diameter, unless noted otherwise on the Contract Drawings. One end shall be threaded to take the grout hose. Threads shall be protected by means of paper or other wrapping.
- C. Design grout connection details and submit for review by the Engineer.

2.2 GROUT MATERIALS

- A. ASTM C150, Type III Portland cement and ultrafine cement shall be used for water control grouting. Store a sufficient quantity of cement at or near the site of the Work to ensure that grouting operations will not be disrupted by shortage of cement. Store the cement properly and protect it from moisture at all times.
- B. Ultrafine cement shall have 95 percent of the particles less than 8 microns with an average particle size of less than 4.5 microns.
- C. Where applicable, set standpipes with a fast-setting, non-shrink grout, or other means acceptable by the Engineer.
- D. The addition of catalysts, activators, inhibitors, buffers, viscosity modifiers, fluidifiers, soluble additives and other substances to change the nature of the grouting materials shall be fully compatible with the grouting materials. Conduct tests to demonstrate compatibility well in advance of their planned use. Forward test results to the Engineer 30 days prior to the planned use of such additives in the Work. Additives shall be accepted for use by the Engineer.

- E. The proposed grout mix is to be environmentally safe to ensure that there are no adverse effects on the environment resulting from grouting operations. Environmental data for the proposed grout constituents and grout mix shall be submitted to the Engineer for approval.
- F. Water shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.

2.3 STANDPIPES/PACKERS FOR DRILLING AND GROUTING

- A. The Contractor may elect to use either standpipes or drill-through packers, depending upon their suitability in the existing ground conditions. Where applicable, set standpipes with a fast setting, non-shrink grout or other means accepted by the Engineer.
- B. Standpipes shall consist of a minimum of 2 inch, Schedule 80, seamless steel pipe. The inner pipe on the packers shall also consist of a minimum of 2-inch, seamless steel pipe fitted with external rubber sleeves, which are capable of being expanded against the side of the initial collar section of the borehole into which the standpipe is to be installed.
- C. Packers may be of any commercially available type. Submit details of such packers to the Engineer for information prior to their use in the Work.

2.4 DRILLING EQUIPMENT

- A. All drilling equipment shall be of a type, capacity and mechanical condition suitable for the Work. And capable of drilling through the ground conditions described in the GBR. The equipment and its powering, and the layout thereof, shall comply with all applicable federal, state and local codes, laws, regulations and ordinances, and is subject to the approval of the Engineer.
- B. Rotary percussive equipment may be used for drilling the probe, grout and test holes. The equipment must be capable of being moved rapidly from one hole to the next. Probe and grout holes shall not be less than 1-3/4-inch diameter. Drills for drilling probe holes, grout holes and test holes for the tunnel shall be capable of drilling holes ahead of the heading for a minimum of 120 feet at acceptable rates of penetration (at least 2.0 feet per minute at a depth of 120 feet) in the strata through which the tunnel will be driven.
- C. Drill rods and drill bits for drilling probe holes, grout holes and test holes shall be of a type specifically designed to drill straight holes and to minimize deviation of the hole.
- D. Equip the drills with external flushing or a means whereby an adequate supply of flushing water is supplied to the bit while drilling the probe, grout and test holes.
- E. Provide at least one spare drill unit as back-up.

2.5 GROUTING EQUIPMENT

- A. All grouting equipment used shall be of a type, capacity and mechanical condition suitable for the Work. The equipment and its powering, and the layout thereof, shall

comply with all applicable federal, state and local codes, laws, regulations and ordinances, and is subject to the approval of the Engineer.

- B. Equipment used for mixing and injecting grout shall be designed for grouting service, shall be maintained in satisfactory condition at all times, and shall be capable of satisfactorily mixing and agitating the grout and injecting it into the grout holes at an essentially uniform flow rate under constant pressure. The minimum grouting equipment furnished shall include, but is not limited to, the following:
1. A cement grout mixer of the colloidal type, capable of providing a homogenized mix. Equip the mixer with a suitable water measuring device calibrated to read in cubic feet and tenths and so designed that, after each delivery, the instrument can be conveniently reset to zero. Provide means for accurately measuring the other grout ingredients at the mixer.
 2. Mechanically driven grout agitator tanks capable of effectively stirring all grout mixes to be used for the grouting operation. Place a 40-mesh-per inch screen between the mixer discharge and these holding tanks to trap any oversized particles.
 3. Pumps shall be capable of delivering not less than 12 gpm of grout at a pressure of 200 psi over the expected grout pressure to be used at the grout hole collar. In addition to the pumps being used in the tunnel, keep a back-up pump of the same capacity and arrangement, and in good working condition, on site at all times.
 4. Such valves, pressure gauges, pressure hose, small tools and accessories as may be necessary to provide a continuous supply of grout and accurate pressure control. The inside diameter of the delivery, return lines and grout nipples, shall be not less than 1-inch. All hoses, valves and fittings, etc. must be rated for a working pressure in excess of 800 psi.
 5. Provide a pressure gauge mounted on the standpipe of each hole being grouted. Gauges shall be provided with "gauge savers" to prevent grout from entering the moving parts of the gauge. The full-scale reading of the gauge shall be no more than 130 percent of the maximum grout pressure to be used.
 6. Use accurately calibrated, high-precision pressure gauges for the periodic checking of the accuracy of all gauges used in the grouting. Such checks should be carried out on a weekly basis and details submitted to the Engineer on the day of the checks. Furnish such gauges and store them in the Engineer's office when not in use, until completion of grouting.

2.6 WATER PRESSURE TESTING EQUIPMENT

- A. Water pressure testing equipment and pressurized water supply shall be available for pressure testing of probe holes immediately following completion of drilling.
- B. Water pressure tests will use either a single packer or double packer system. The expandable rubber sleeves (packers) shall be capable of forming a watertight seal within the probe hole.
- C. The water pressure testing system and its components must be capable of withstanding the required pressures for executing the tests.

- D. The pressure gauge and flow meter shall be calibrated and the calibration certificates supplied to the Engineer at least 30 days prior to their use.
- E. Use accurately calibrated, high-precision pressure gauges for the periodic checking of the accuracy of all gauges used in water pressure testing. Such checks should be carried out on a weekly basis and details submitted to the Engineer on the day of the checks. Furnish such gauges and store them in the Engineer's office when not in use, until completion of the testing operations.

PART 3 EXECUTION

3.1 GENERAL

- A. Inform the Engineer at least 12 hours in advance of any probing, drilling or grouting operations.
- B. Prior to the commencement of any probing operations, check that the grouting equipment is fully operational and that there is a sufficient supply of grouting products available on site to execute a full grouting operation should unfavorable conditions be encountered during drilling.
- C. A minimum length of probed ground as indicated on the Contract Drawings, or equivalent to two advance or blast round lengths, or as directed by the Engineer shall be maintained ahead of the advancing tunnel heading measured prior to any blast or advance.
- D. A single probe hole shall be drilled at intervals along the length of the Exploratory Tunnel as shown on the Contract Drawings. These single probes shall be drilled on alternating sides of the tunnel and be overlapped such that at all times there is a minimum length of probed ground ahead of the tunnel heading as detailed in the Contract Drawings, unless agreed otherwise by the Engineer. Additional probe holes may be required should either the water inflow criteria be exceeded or a feature be encountered that requires additional investigation, or as directed by the Engineer.
- E. Exploration probe holes shall be drilled at the locations as indicated on the Contract Drawings.
- F. The Engineer will determine core hole locations based on the results of probe hole drilling.
- G. Keep a complete and written record of the ground conditions revealed by probe holes. The written record shall be in the format as detailed in Section 1.4.C.
- H. High permeability zones shall be anticipated during probe hole drilling and shall be grouted. Drilling methods shall be capable of dealing with water head as stated in this Section.

- I. Dispose of all drill cuttings and drilling fluids and remove all debris, which will interfere with future tunnel excavation subject to the approval of the Engineer.
- J. All drilling Work shall be performed within the limits specified in the Contract Documents.
- K. In locating the drill, position the hole such that no damage is caused to the existing fiberglass rock dowel support during the drilling process.
- L. Replace any probe or grout hole that is lost or damaged due to loss of drill string, mechanical failure of equipment, inadequacy of grout supply, or Contractor error by another hole or holes at the Contractor's sole expense.

3.2 STANDPIPES/PACKERS

- A. Collar all probe, grout and test holes with standpipes or packers, and if necessary, a suitable high-pressure, drill-through valve.
- B. Only carry out drilling and grouting through standpipes/packers of adequate length, properly secured into the rock. They shall have been pressure-tested for leakage at pressures of 50 psi higher than those pressures required for grouting, and, if necessary, fitted with a suitable high-pressure, drill-through valve.
- C. The length of standpipe/packer shall be appropriate for the existing ground conditions and the pressures to be applied, as accepted by the Engineer.
- D. Adopt standpipe installation procedures that allow the standpipe to be pressured up, by the grout, against the seal provided by the rubber sleeves tightened against the sides of the hole, at its collar.
- E. Install all standpipes using a fast-setting, non-shrink grout. Perform any subsequent re-injection that may be necessary. Perform with an appropriate non-shrink grout.

3.3 PROBE HOLE DRILLING

- A. Perform probe hole drilling ahead of the tunnel, and at other locations as shown on the Contract Drawings and as directed by the Engineer.
- B. A probe hole shall be considered to be complete when the pre-determined final depth has been reached, or sufficient quantities of water have been intercepted in any of the probe holes at that same drilling station such that grouting must be performed or if the drill cannot be advanced through the encountered ground conditions.
- C. Pre-excavation grouting shall be performed in utilizing the drilling testing and grouting sequence flow chart defined in the Contract Drawings.
- D. Pre-excavation grouting will be required when water inflows exceed the values given in the GBR.

- E. Where the applicable probe hole inflow criteria is exceeded or where the results of probe drilling indicates that grouting is required to improve stability of the excavation, measure the hydrostatic pressure and perform pre-excavation grouting. The pre-excavation grouting shall be performed in accordance with the Contractor's program for pre-excavation grouting. A revised proposal for each grouting exercise shall be submitted to the Engineer for approval.
- F. Upon completion of drilling as defined herein, wash the hole and allow the probe hole to flush, until the return water is clean.
- G. Make sufficient measurements to determine the amount of water inflow from the probe and drill holes into the excavation and to allow the hole interconnections and the rates from individual probe holes as well as the total from all probe holes to be assessed. As a minimum, observation and/or measurement of the flow from the hole will be made during the addition of each drill rod to the drill string, at the completion of drilling and on removing the drill string.
- H. Gas testing will be performed on all probe holes to monitor: oxygen deficiency; carbon monoxide levels; hydrogen sulfide levels; and the presence and levels of explosive gases such as methane etc. The results of the gas testing will be recorded on the probe hole drill log to be submitted to the Engineer.
- I. Water Pressure Tests
 1. Water pressure tests shall be carried out over 20 foot lengths of the probe holes for the complete length of each probe hole.
 2. The water pressure test will use either a single packer or double packer system. If a single packer system is used then the testing is to be undertaken after each 20 foot advance of the probe hole. The single packer is to be placed 20 feet from the end of the hole for each test.
 3. Single packer water pressure tests shall be performed for short probe holes.
 4. Comprehensive Water Pressure Test for Long Probe Holes: Water shall be pumped into the hole over the requisite 20-foot length. The pressure shall be increased in three stages to the maximum test pressure specified by the Engineer and then subsequently reduced in two further stages (i.e. $\frac{1}{4}P_{\max} \rightarrow \frac{1}{2}P_{\max} \rightarrow P_{\max} \rightarrow \frac{1}{2}P_{\max} \rightarrow \frac{1}{4}P_{\max}$). For each pressure increment or decrement, the pressure will be maintained for 10 minutes or until a uniform flowrate is attained, whichever is longer. If a uniform flowrate is not reached within 20 minutes the test equipment will be checked and the test re-performed. If no reason can be determined, record the flow and terminate the test. The quantity of flow and gauge pressure should be recorded at one minute intervals up to five minutes and at five minute intervals thereafter. The pressure at which flow commences on the incremental stage and the pressure at which flow stops on the decremental stage are to be carefully observed and recorded. The results of the water pressure tests will be used in defining the parameters for the grouting procedure.
- J. Upon completion of the probe hole drilling and testing, seal all those holes that do not reveal a requirement for grouting with a cement grout having a water : cement ratio, by weight, of 0.7:1 or less, in a manner to ensure complete filling of the holes. Probe holes

that reveal a requirement for grouting will be grouted in accordance with the procedure defined in this Specification and as shown on the Contract Drawings.

3.4 GROUT HOLE DRILLING

- A. Perform grout hole drilling where determined necessary as a result of the probe drilling results in accordance with the Contractor's pre-excavation grouting program. The minimum diameter of grout holes shall be 1-3/4 inches at the point of maximum penetration. Measure all grout holes from the collar of the hole and drill to the depth shown on the Contract Drawings, as directed by the Engineer or determined from the Contractor's pre-excavation grouting program.

3.5 GROUTING PROCEDURES

- A. Perform grouting using primary, secondary, tertiary and quaternary patterns of four grout holes, as required. Perform grouting ahead of the tunnel heading in stages as determined necessary or as shown on the Contract Drawings or as directed by the Engineer. The exact nature of the program will be determined in the field as appropriate to the conditions encountered and be based on the Contractor's program for pre-excavation grouting or as directed by the Engineer. Submit proposed program to the Engineer for approval prior to commencement of grouting operations.
- B. The lengths of the stages will be determined by water inflow measurements taken from the original probe holes or from the first holes drilled in each stage of the grout cover. As a minimum, observe or measure and record: the inflow during the addition of each drill rod to the drill string after ensuring all drill water has drained from the hole as necessary, the total residual water inflow upon removal of the drill string, and any significant changes during drilling.
- C. At the completion of drilling or re-drilling each stage, and prior to commencing any injection, each hole shall be carefully washed out or allowed to flush itself, until the return water is clean. Allow any loose material encountered in the holes to flush out of the holes.
- D. Use the water inflow measurements and results of the water pressure tests to determine the groutability of the formation.
- E. Where necessary pre-excavation grout holes shall be grouted through a manifold fitted with valves, gauges, meters and controls to enable grouting of each hole independently.
- F. Grouting may be controlled by the Grouting Intensity Number (GIN) principle. Three criteria for grouting are set: a maximum grout pressure (p_{max}); a maximum grout volume (V_{max}); and a maximum grouting "intensity" – referred to as a Grouting Intensity Number or GIN. The GIN criteria for grouting will be determined by the Engineer on the basis of field observations. The GIN criteria are not to be exceeded unless instructed by the Engineer. The actual GIN is evaluated during the grouting process by taking the product of the grout pressure and grout volume: $GIN = p \times V$. The GIN value is determined at a nil grout flow-rate – that is at pumps stopped. Refusal is achieved when any of the three GIN criteria are met.

- G. Generally, maintain grout flow rates as high as practical as long as the allowable grouting parameters are not exceeded. Discard any cement grout mix, which is more than one hour old.
- H. Keep equipment and grout lines clean during grouting operations. Flush out all equipment and grout lines after grouting each stage in a hole. Properly dispose of all waste and contaminated water in accordance with these Contract Documents and permit requirements.
- I. The grouting of a stage within a hole shall be considered to be complete when the grout take reaches refusal as defined in this Section. After the grouting of a stage within a hole is completed, maintain the pressure in the hole by closing the shut-off valve and leave the valve in place until the grout has set sufficiently to be retained in the hole. Only after the grout has set or gelled shall the hole be redrilled and washed.

3.6 HOLE SEALING

- A. At the completion of all grouting, redrill and clean all the grout holes as necessary and fill and seal them with a cement grout having a water:cement ratio of 0.7:1, by weight, or less, in a manner to ensure complete filling of the hole. Apply an appropriate grouting pressure to the hole to affect the final seal as accepted by the Engineer.
- B. Following a grouting operation the grout shall be allowed to cure to initial set prior to re-starting excavation operations. When the sealing grout has set up, remove the valves, fittings and grouting equipment from the probe.

3.7 TESTS AND INSPECTIONS

- A. Any data or notes taken by the Engineer during periodic inspections of grouting shall not relieve the Contractor's responsibility in documenting grouting operations. Assist the Engineer by providing all facilities and assistance necessary for inspection of probing and grouting operations.
- B. Furnish one set of calibrated pressure gauges and flow meters to be used as a master to check pressure gauges and flow meters in the field. Proper certifications attesting the same shall be provided to the Engineer. Proper fittings shall be provided for connection of calibrated pressure gauges and flow meters parallel to field gauges and flow meters for periodic checking.

END OF SECTION

SECTION 31 71 29

CONTROL AND REMOVAL OF TUNNEL WATER

PART 1 GENERAL

1.1 SUMMARY

- A. The Work specified in this Section includes the designing, furnishing, installing, maintaining, operating, monitoring and removing of temporary systems installed to control and remove tunnel water during tunnel construction and on completion of construction until such time when the ownership of the Exploratory Tunnel is transferred to the Cabinet.
- B. Ground water inflows shall be controlled by suitable means, as specified on the Contract Drawings or accepted by the Engineer, to ensure that any impacts on the ground water regime as a result of tunnel construction are minimized.
- C. The method of handling, conveying and removing tunnel water shall be by whatever means necessary and acceptable to the Engineer to obtain satisfactory working conditions and maintain progress and safety of the tunnel construction and related work.
- D. Provide all labor and materials for building dams, weirs, sumps, pumps, discharge lines, and flow control structures, and furnish and install all equipment required to control, handle, monitor, instrument and convey tunnel water to a sump near the tunnel portal. Tunnel water will be pumped from this sump for onward treatment and disposal.
- E. Protect tunnel and tunnel portal against surface-runoff water.
- F. Related Sections:
 - 1. Special Note For Submittal Procedures
 - 2. Section 01 51 00 Tunnel Ventilation and Utilities

1.2 REFERENCES

- A. Definitions
 - 1. Tunnel Water: All water, whatever the source that is within the tunnel. This includes, but is not limited to:
 - a. Ground water inflow
 - b. Water resulting from tunnel construction operations
 - c. Water resulting from emergency rescue operations
 - d. Water resulting from geotechnical exploration operations
 - e. Water that may inadvertently enter the tunnel at the portal
- B. Reference Standards
 - 1. American Society for Testing and Materials
 - a. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

1.3 PERFORMANCE REQUIREMENTS

- A. Maintain and submit, on a daily basis, shift records including daily pump discharge quantities from metering stations at the tunnel portal. Continuous recording flow meter(s) with flow totalizing capability shall be provided. Calibrations shall be performed at least every six months and as necessary.
- B. The pumping stations shall be capable of operating 24 hours a day, seven days a week, for the duration of the Project as required. With the consent of the Engineer, the pumps may be operated intermittently. Assess the reliability and redundancy of all systems for pumping to provide sustained operating capacity.
- C. The tunnel construction water removal system shall have a remote alarm capability and an emergency back-up power supply.
- D. Due to the downgrade nature of the tunnel excavation two separate pumping systems must be installed such that in the event of a power failure to the primary system the back up system will operate independently to ensure that the full capacity of the system is maintained. Make allowance such that pumping capacity can be maintained in the event of a complete power shutdown due to a gas alarm event.

1.4 SUBMITTALS

- A. Submittals shall conform to Special Note For Submittal Procedures.
- B. Submit shop drawings, descriptions, and a Work Plan narrative of the proposed tunnel water control facilities, to the Engineer for approval at least 30 days before such facilities shall be installed, including but not limited to, equipment, methods, standby equipment and power supply; instrumentation layouts; provisions for measuring pumped water as required; and monitoring procedures. A schedule of installation and details of the system operation shall also be submitted. A contingency plan and options shall also be submitted. Resubmit as appropriate if the system is modified during installation or operation. Examples of the record forms to be maintained shall also be submitted.
- C. The pumping system shall be designed by a firm with a minimum of 5 years of experience designing pumping systems and signed by a Professional Engineer registered in the Commonwealth of Kentucky.
- D. Submit shop drawings of temporary tunnel sump locations, and pump and discharge piping layouts.
- E. Submit manufacturer's instructions for pumps, water meters, flow measuring devices, and associated equipment.

1.5 SCHEDULE OF BID ITEMS

- A. Measurement
 - 1. General Principles of Measurement and Payment:

- a. The Cabinet will only measure that quantity of natural ground water, which arises within the tunnel and has to be pumped for its removal from the underground Work and all necessary incidentals in the units listed in the Payment Subsection.
 - b. The bid item in the Access Ramp Drawings shall include provisions and subsequent removal to the necessary settlement basin and other water treatment requirements (including the use of chemical flocculants if necessary) for the discharge of water from the Works and transmission of the water to discharge point and all expenses for discharging to receiving system.
 - c. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Water used for construction purposes, emergency purposes, or water from any other sources outside the Work but which enters the Work.
2. Control of Tunnel Water
- a. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Items required to control ground water in the tunnel to ensure continuity of ground water flows, except the use of pipes to connect solution channels as shown in the drawings, as others shall be deemed incidental to the Work.
3. Removal of Tunnel Water:
- a. The Cabinet will measure pumping and all necessary incidentals according to the units listed in the Payment Subsection.
 - b. Supply, install, calibrate, maintain and subsequently remove accepted measuring devices for measuring the quantity of water removed for which he desires payment in accordance with the provisions of this Subsection. Measurement will be determined from consecutive readings of the measuring device and provision of results to the Engineer at the intervals as specified in the Contract.
 - c. The measurement of the pumped flow shall be made at a place which measures only the flow from the tunnel heading; where staged pumping is required to remove water from the heading to the surface; this rate of water flow shall be measured immediately prior to discharge into the lower elevation sedimentation basin shown on the Access Ramp Contract Drawings.
 - d. Separate pumps shall be established according to the requirements of the Access Ramp Contract Drawings to transfer water from the lower elevation sedimentation basin to the upper elevation sedimentation basin. No payment shall be made for this operation and costs arising from the establishment and maintenance of appropriate equipment should be assigned to the scheduled payment items identified under the Access Ramp portion of this Contract.
 - e. The measurement of the volume of water used for construction purposes shall be made by an acceptable water meter where the supply main enters the tunnel.

- f. Measurement will be the net volume of natural ground water (net natural ground water volume = measured volume of pumped water minus measured volume of construction water), pumped from each particular heading, averaged over each 24-hour period at the appropriate rate.
- g. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) Operating and running of pumping equipment, moving pumping equipment to suit the advancing heading and the various measuring devices including the use and maintenance of these. Maintenance of surface facilities required for the treatment and discharge of the water pumped from the underground Work to a suitable drainage location. The installation of such facilities is covered under Access Ramp Contract Drawings and Specifications.
 - 2) Installation, operation and removal of pumping facilities to deal with ground water in the underground Work by means of pumping inclusive of water in surface Work that originated from the underground Work.
- 4. Removal of Water From Surface Work
 - a. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - 1) The Cabinet will not measure the removal of water from surface Work under this Section as this is covered by Access Ramp Contract Drawings and Specifications
- 5. Removal of Solution Channel Groundwater Inflow: A 4-inch diameter steel pipe for diversion of dissolution channel groundwater inflow, as shown on the Contract Drawings, shall be installed to the Engineer's satisfaction.

B. Payment

- 1. The Cabinet will make payment for the completed and accepted quantities under the following:

Code	Payment Item	Pay Unit
22323NN	Pumping: daily	Each
22327NN	Water treatment	Lump Sum
22328NN	Pipe for diversion of solution channel groundwater inflow	Linear foot

PART 2 PRODUCTS

- 1. Dissolution Channel Groundwater Inflow Pipe
 - a. Standard 4-inch diameter steel pipe in accordance with ASTM A53

PART 3 EXECUTION

3.1 General Requirements

- A. Remove water from the tunnel during excavation. Place and size tunnel construction water pumping stations to handle required flows specified in the Geotechnical Baseline Report (GBR) plus any extra capacity required to handle Contractor-supplied water and other flows resulting from tunnel construction operations as well as water resulting from emergency rescue operations, geotechnical exploration operations, water that may inadvertently enter the tunnel at the portals.

3.2 Emergency Preparedness

- A. When the Contractor is excavating and encounters large amounts of water draining into the excavation, immediate steps shall be taken to control the water source. Large amounts of water requiring control shall be defined as those that adversely affect the performance of the Work under this Contract and/or amounts that have the potential of resulting in improper operation of sedimentation basins, treatment systems, or causing a loss or damage to adjacent properties.

END OF SECTION

SECTION 31 72 13

ROCK REINFORCEMENT AND SUPPORT

PART 1 GENERAL

1.1 SUMMARY

- A. The Work of this Section includes requirements for furnishing all labor, materials, tools, and equipment, and performing all operations necessary for installing and testing of rock reinforcement and initial and local support systems and elements used in portal face reinforcement and in tunnel and exploration bay construction as shown in Contract Drawings and specified herein.
- B. Provide support to the ground for safety, to prevent loss of ground, and to keep the perimeters and faces of portal and tunnel excavations stable for the duration of the Contract.
- C. Support elements defined in this Section consists of the following:
1. Rock bolts
 2. Rockfall protection mesh
 3. Welded wire fabric
 4. Canopy tubes,
 5. Self-Drilling anchors,
 6. Steel rib supports
 7. Spiles
- D. Install the above support elements in the combinations indicated on the Drawings to provide initial and supplementary local support and rock reinforcement to the portal face and within the underground tunnel excavation.
- E. Keep sufficient quantities of support elements on site at all times to not disrupt the Work as a consequence of variations in ground conditions requiring the adoption of different support types as excavation proceeds.
- F. Use shotcrete in conjunction with the rock reinforcement as shown on the Contract Drawings.
- G. Related Sections:
- | | | |
|----|---------------------|--------------------------------------|
| 1. | Special Note | For Construction Phasing |
| 2. | Section 01 32 23 | Tunnel Surveying |
| 3. | Special Note | For Submittal Procedures |
| 4. | Section 03 37 13 | Shotcrete |
| 5. | Section 31 71 16.01 | Tunnel Excavation by Drill and Blast |
| 6. | Section 31 71 23 | Mechanical Tunnel Excavation |

1.2 REFERENCES

A. Definitions

1. Initial Support System: Combination of initial support elements installed on the portal face and in the tunnel and exploration bays to provide rock reinforcement for excavation stability, and safety during construction.
2. Initial Support Element: General term for rock bolts, welded wire fabric, rockfall protection mesh and shotcrete, with related support accessories.
3. Local Support Element: General term for rock bolts, welded wire fabric, rockfall protection mesh, steel ribs, shotcrete, fiber shotcrete, spiles, self-drilling rock anchor, and canopy tubes with related support accessories.
4. Supplementary Local Support: Combination of local support elements installed by the Contractor in addition to the initial classified support types indicated on the Contract Drawings at the approval or direction of the Engineer.
5. Rock Reinforcement: achieved through the installation of initial support elements in the initial support types indicated on the Contract Drawings, which reinforce the in-situ rock and increase the capacity of the rock to support itself.
6. Initial Support: In the tunnel, the ground conditions encountered using a recognized rock assessment methodology, will determine the initial support type selected. Initial support types are as indicated on the Contract Drawings.
7. Temporary Support: Ground support comprising initial, or supplementary local, support elements installed additional to the support types shown on the Drawings at the Contractor's option and at no additional cost to the Cabinet.
8. Pre-Support: Support Elements fully installed, grouted and tensioned where applicable prior to subsequent excavation stage.
9. Rock Bolt: is a fully-grouted, threaded bar, steel or fiberglass, installed in a drilled hole with standard end hardware and tensioned or torqued to a specific load.
10. Welded Wire Fabric: Reinforcement placed on the exposed rock surface to support or contain loosening, raveling or falling rock between rock bolts, intermediate holding down pins and steel ribs.
11. Standard End Hardware: consists of a bearing plate, one or more beveled and flat washers, and a hexagonal nut appropriate for the bar material.
12. Spile: Untensioned self-drilling anchor installed and grouted in a drill hole at a low angle to the longitudinal axis at the tunnel heading ahead of the tunnel excavation face to pre-support the ground, or fiberglass bar installed into

surfaces of karstic features exposed as a consequence of tunnel excavation prior to grouting. Fully grouted and installed spiles without pre-tensioning and without end hardware may consist either of a self-drilling anchor or fiberglass bar installed in a percussion-drilled hole, and then fully grouted.

13. Self-Drilling Anchor: A self-drilling groutable anchor is a hollow bar that is capable of being drilled a specified length in the ground conditions anticipated. A sacrificial hardened cruciform bit or button bit shall equip the bar as required by the ground conditions and have a means of providing water flush during the drilling operation. The bar shall be capable of being fully grouted in position without being removed from the self-drilled hole.
14. Canopy Tubes: Perforated steel pipes installed at the tunnel heading ahead of the tunnel excavation face and grouted as a means to pre-support the ground. The tube shall be capable of being fully grouted in position without being removed from the hole following removal of drill bit and associated drill rods.
15. Embedded Length: This is the length of the rock bolt, spile or self drilling anchor or canopy tube that is to be embedded in the rock and is shown on the Contract Drawings. This does not include the length of support element that protrudes from the end of the hole and is threaded to allow for the installation of the faceplates, nuts etc. required for the specific element.
16. Portal Reinforcement: Support elements installed on the surface of the exposed portal face that consists of steel rock bolts, rockfall protection mesh, fiber shotcrete, or a combination thereof as indicated on the Contract Drawings.
17. Rockfall Protection Mesh: Steel woven wire mesh used as a drapery system on the surface of portal excavation surfaces to prevent rock or debris loosened from slope from falling onto an area below the excavation face and held in place by attachment to rockbolt end hardware or intermediate holding down pins.
18. Tunnel Portal Reinforcement: Support elements installed from within the tunnel in the initial 30-foot length of tunnel excavation.

B. Reference Standards

1. American Concrete Institute:
 - a. ACI 440.1R-01 – Guide for the Design and Construction of Concrete Reinforced with FRP Bars
2. American National Standards Institute:
 - a. ANSI B1.1 – Unified Inch Screw Threads
3. American Society for Testing and Materials:
 - a. ASTM A36 – Carbon Structural Steel
 - b. ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement
 - c. ASTM A436 – Austenitic Gray Iron Castings
 - d. ASTM A563 – Carbon and Alloy Steel Nuts

- e. ASTM A569 – Steel, Carbon, Hot-Rolled Sheet and Strip, Commercial Quality
- f. ASTM A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- g. ASTM A706 – Low-Alloy Steel Deformed Bars for Concrete Reinforcement
- h. ASTM A4435 – Rock Bolt Anchor Pull Test
- i. ASTM C579 – Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
- j. ASTM C1107 – Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- k. ASTM D638 – Tensile Properties of Plastics
- l. ASTM D3916 – Tensile Properties of Protruded Glass-Fiber – Reinforced Plastic Rod
- m. ASTM D4435 – Standard Test Method for Rock Bolt Anchor Pull Test
- n. ASTM F 432 – Standard Specification for Roof and Rock Bolts and Accessories

1.3 PERFORMANCE REQUIREMENTS

- A. At any location on the excavated profile of the portal face or underground Work may require rock support measures and the bid items submitted for the Work shall allow for this situation.
- B. Operators who can satisfy the Engineer that they are experienced in the various procedures specified, will only undertake installation and testing of rock support for the surface and underground Work.
- C. The diameter, orientation, method of drilling, lengths of drill holes for rockbolts, self-drilling anchors and canopy tubes, and cleaning shall be such that the correct setting and anchorage of the bolts and support elements achieved the satisfaction of the Engineer.
- D. Test steel rock bolts as specified herein.
- E. Fully encapsulate fiberglass rock bolts in resin, torque loaded and test them as specified herein.
- F. Use cement grout for the self-drilling rock anchors and test them as specified herein.

1.4 SUBMITTALS

- A. Submittal shall conform to Special Note For Submittal Procedures.
- B. Support Selection Procedure: Prepare and submit the support selection procedure for use in determining the classified initial support types to be installed to the Engineer for review and acceptance. A recognized rock classification system such as the Norwegian Geotechnical Institute (NGI) Q Classification will base the selection procedure as described in the Geotechnical Baseline Report. It shall indicate the methodology to use to assess the encountered ground conditions during tunnel construction to determine the

required initial support types to install as indicated on the Contract Drawings, requirements of this Section and the GBR together with any supplemental local support required.

- C. Submit samples including end hardware to the Engineer of the various sizes and types used, at least 30 days prior to the purchase of support elements, from the normal stock of the manufacturer. Submit samples of the resin cartridges for each setting period used.
- D. Submit applicable literature from the rock reinforcement hardware, grout, mortar, and resin manufacturers, to the Engineer, including the manufacturer's recommended installation procedures for steel rock bolts, rockfall protection mesh, fiberglass rock bolts, self drilling anchors, welded wire fabric, canopy tubes, fiberglass spiles and steel ribs. Submit also the following:
 - 1. Certificates stating that samples for testing are from normal stock.
 - 2. Certified mill reports of the steel rock bolts, rockfall protection wire mesh, self drilling anchors, steel ribs, welded wire fabric and/or International Standards Organization (ISO) certificates for the fiberglass support elements, and end hardware. .
 - 3. Manufacturer's certified test results of gel time, shelf life, and working strength for each type of grout and resin to be used.
- E. Drawings
 - 1. Prior to beginning Work, submit shop and Working Drawings showing but not limited to the following information:
 - a. Locations, installation procedures, and layouts of support elements to provide the initial support systems indicated on the Contract Drawings.
 - b. The spacing, type, size and length of support elements together with the type of accessories and surface covering and construction execution sequence.
 - c. Relationship between time and distance from the excavated face for installation of the support elements as indicated on the Contract Drawings.
 - 2. Shop drawings and calculations for steel ribs, showing sizes, details and arrangements of members, method of assembly, lists of materials, and method of erection and blocking. A Professional Engineer licensed in the Commonwealth of Kentucky shall seal such drawings and calculations.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements for submittals.
- B. Provide as-built records information in a format agreed with the Engineer regarding placement layouts of rock bolts, rockfall protection mesh, steel ribs, fiberglass rock bolts, welded wire fabric, self drilling anchors, canopy tubes, shotcrete, fiber shotcrete spiles and any other support element installed together with an indication of the rock conditions encountered based on the rock assessment undertaken at the time of excavation. Differentiation shall be made between the material properties of the individual support elements. Locations and elevations of the geotechnical instrumentation, in-tunnel survey

control stations, and tunnel stationing markers installed shall also be indicated on these drawings.

1.6 QUALITY ASSURANCE

- A. Section 01 40 00 - Quality Requirements
- B. Install rock bolts, spiles, self-drilling anchors and canopy tubes in accordance with the manufacturers' recommendations and the requirements of this Section. Use particular care to ensure that the appropriate hole diameter-grout cartridge diameter-rock reinforcement bar diameter combination is used to yield adequate resin (or cement) grout for full rock bolt encapsulation.
- C. Obtain support elements and accessories, grout and resin from an established manufacturer who has regularly engaged in production of these products for a minimum of 5 years.
- D. Qualifications of Manufacturer: Resin and grout used with support elements shall be the product of an established manufacturer who has regularly engaged in production of these products for use with rock reinforcement for at least five years.
- E. Installation of support elements shall be in accordance with the recommendations of the grout, resin and support element manufacturer and this Specification. When such recommendations differ from the requirements of this Section, this Section governs.
- F. An independent certified testing laboratory will make calibrations of jacks and gauges used for pull tests.
- G. No part of any support elements shall be within the C-line shown on Contract Drawings.
- H. Rock Bolts: Perform pull tests in accordance with the requirements of ASTM D 4435 and as specified herein.
- I. Install fiberglass rock bolts and torque loaded to a minimum of 50 foot-lbs. before excavation of the next round.

1.7 SCHEDULE OF BID ITEMS

- A. Measurement
 - 1. The Cabinet will measure the supply and installation of rock support and the rates shall include for all disruption to other Work due to the installation of the support.
 - 2. Portal Face Support:
 - a. The Cabinet will measure the supply and installation of the portal face support in the surface excavation in the units listed in the Payment Subsection.
 - b. The Cabinet will not measure the following for payment and will consider it incidental to this item of work:

- 1) All additional geotechnical investigation, testing, logging, mapping, slope re-design, and as may consider monitoring necessary to ensure that the support installed will provide a stable and safe working environment.
- 2) Supply, delivery and handling on site of all materials and equipment required to install the tunnel portal rock support.
- c. Rock bolts:
 - 1) The Cabinet will measure the supply and installation of steel rock bolts for primary support in portal face excavations, in the units listed in the Payment Subsection.
 - 2) Measurement of rock bolts will be by number of effective bolts installed and the Engineer will accept them at any orientation required. Make distinction between rock bolts of different lengths.
 - 3) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Supply of all materials including the bolt, bearing plate assemblies, resin cartridges or cement grout, drilling of holes, water pressure tests where required, installation and tensioning of rock bolts and the replacement of any damaged or defective rock bolts. Include in the rate all trials to establish correct grouting and anchorage procedures, and all tests on the effectiveness of the bolt installations and installation of this support.
- d. Rockfall protection mesh reinforcement:
 - 1) The Cabinet will measure the supply and installation of rockfall protection mesh reinforcement in the units listed in the Payment Subsection by the net area in square feet. Base the net area, with no allowance for laps, of mesh fixed to the excavated surface, on an area measured on the theoretical excavation profile given on the Drawings.
 - 2) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - a) Supply and installation including all methods of holding mesh against the rockface, such as supplementary straps or spiders and assemblies attached to heads of rockbolts, and intermediate holding down pins and tying wire and other incidental fixings. Installation of this support.
3. Underground Tunnel Support:
 - a. Principles of measurement and payment
The following general principles for measurement and rates shall apply to the installation of underground rock reinforcement elements such as rockbolts (steel in support Type P in tunnel at portal and fiberglass in all other support Types), welded wire fabric, self-drilling anchors, canopy tubes, or ribs within each support type:
 - 1) Initial support:

Measure rock reinforcement installed as initial support in the Exploratory Tunnel underground Work as follows:

- a) Reimburse initial support disruption, that is the disruption to the advance of the tunnel heading or excavation face by the installation of initial support, against the rates submitted for excavation of tunnel under code numbers and payment items applicable:
 - (1) Excavation requiring Support Type at Tunnel Portal P (Mandatory Pattern)
 - (2) Excavation requiring Support Type I
 - (3) Excavation requiring Support Type II
 - (4) Excavation requiring Support Type III
 - (5) Excavation requiring Support Type IV (Below US 42 – Mandatory Pattern)
 - (6) Excavation requiring Support Type EBC
 - b) The Cabinet will measure the supply and installation of rock reinforcement elements in the units listed in the Payment Subsection for the Exploratory tunnel and bays. Make a distinction for the rock reinforcement types.
 - c) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - (1) Any additional Temporary Support (see Subsection 1.2.A.7) the Contractor installs to satisfy requirements for safety of the Work.
4. Karstic Voids: Reinforce by one or more of the following elements defined below, as agreed with the Engineer and shown on the Contract Drawings, the ground excavated within the Exploratory Tunnel that karstic features are anticipated to impact it. The Cabinet will measure the elements used on a unit quantity basis subject to their approval of being satisfactorily installed as described in the specification and as instructed by the Engineer.
- 1) Rock bolts (fiberglass):

The Cabinet will measure the rock bolts by the total number of effective bolts installed and accepted at any orientation as agreed by the Engineer.

 - a) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - (1) Supply of all materials including the bolt, faceplate assemblies, resin cartridges or cement grout, drilling of holes, standard acceptance and proof testing of bolts, installation and tensioning of rock bolts and the replacement of any damaged or defective rock bolts.
 - 2) Self-drilling rock anchors:
 - a) The Cabinet will measure the number of effective anchors installed and accepted at any orientation

- required by the Engineer. Make distinction between self-drilling rock anchors of different lengths.
- b) Make distinction between those self-drilling rock anchors placed as initial support and those placed as balance, supplemental or upgrading of support.
 - c) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - (1) Supply of all materials including the anchor, grout, drilling of holes, installation of anchors and the replacement of any damaged or ineffective anchors.
- 3) Canopy Tubes:
- a) The Cabinet will measure the number of effective tubes installed and accepted at any orientation required by the Engineer. Make distinction between tubes of different lengths.
 - b) Make distinction between those Canopy Tubes placed as initial support and those placed as balance, supplemental or upgrading of support.
 - c) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - (1) Supply of all materials including the Canopy Tubes, grout, drilling of holes, installation of anchors and the replacement of any damaged or ineffective anchors.
- 4) Welded Wire Fabric:
- a) The Cabinet will measure the net area in the units listed in the Payment Subsection, with no allowance for laps, of welded wire fabric fixed to the excavated surface based on an area measured on the theoretical excavation cross section profile (designated on drawings as the "A" line (payment line) as accepted by the Engineer.
 - b) Install welded wire fabric as initial support in line with excavation as shown in the Drawings. Make a distinction between welded wire fabric placed as initial support and that placed as supplemental or upgrading of support.
 - c) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - (1) Supply and installation including all methods of holding mesh against the tunnel surfaces, such as supplementary straps or spiders and assemblies attached to heads of rockbolts, and intermediate holding down pins and tying wire and other incidental fixings.

- 5) Steel ribs:
- a) The Cabinet will measure the supply and installation of supplemental steel ribs as instructed by the Engineer by weight of steel section in the units listed in the Payment Subsection.
 - b) Subject to the agreement of the engineer the quantity of steel delivered to site by formal submittal in accordance with these Specifications.
 - c) The Cabinet will not measure the following for payment and will consider it incidental to this item of work:
 - (1) Fittings, such as floor plates, splice plats, tie bars, bolts, cross bracing.
 - (2) Ribs of different steel profiles types and weight.
 - (3) Supply and installation of rib joist, frame, post, fittings and invert sections, cut to required dimension, delivered to site and stored until required.
 - (4) Transport from storage into the Exploratory Tunnel, erection in position including installation of all fittings, cross bracing and footing concrete or shotcrete.
5. Supplemental Support:
- a. Supplemental support shall include; balance of rock support, supplemental support and support upgrade.
 - 1) Balance of rock support - rock reinforcement not previously installed with the agreement of the Engineer as initial support, but subsequently installed in the Exploratory Tunnel Underground Work at an agreed distance behind the advancing heading on completion of tunnel photographic, survey or geotechnical mapping operations
 - a) Supplemental support - Rock support to upgrade the initial support type installed with the agreement of or at the direction of the Engineer.
 - 2) Support upgrade - to upgrade the initial support installed near completion of excavation or immediately following construction of the tunnel and prior to the commencement of the maintenance period of the tunnel.
 - b. The Cabinet will measurement all supplemental support types per requirements and units provided above and as follows:
 - a) The supply and installation of the individual elements of initial support will be measured under the code numbers and payment items defined below for:
 - (1) Rock bolts (steel or fiberglass)
 - (2) Self-drilling rock anchors
 - (3) Canopy Tubes
 - (4) Welded Wire Fabric
 - (5) Steel ribs

- b) No distinction will be made for support installed in the various support types.
- c) No separate measurement will be made for any disruption to the advance of the tunnel heading or the excavation face arising from the installation of the balance of rock support and such effect if any shall be allowed for in the rates bid for these support elements

B. Payment

1. The Cabinet will make payment for the completed and accepted quantities under the following:

Code	Payment Item	Pay Unit
Portal Face Support Items:		
22340EN	Rockfall Protection Mesh Reinforcement – Portal Face	Square foot
22341NN	Steel Rock Bolt, 10-ft Embedment	Each
22342NN	Steel Rock Bolt, 20-ft Embedment	Each
Exploratory Tunnel: tunnel reinforced in each support type as shown on the Drawings by length of tunnel reinforced:		
22343EN	Rock reinforcement in Type P Support in Tunnel at Portal (Mandatory)	Linear foot
22344EN	Rock reinforcement in Type IV Support in Tunnel (Under US 42 Mandatory)	Linear foot
22345EN	Rock reinforcement in Type I Support in Exploratory Tunnel	Linear foot
22346EN	Rock reinforcement in Type II Support in Exploratory Tunnel	Linear foot
22347EN	Rock reinforcement in Type III Support in Exploratory Tunnel	Linear foot
Exploration Bay: Rock Reinforcement Elements in specified support type by length of exploration bay reinforced.		
22348EN	Rock reinforcement in Type EBC Support in exploration bay	Linear foot
Karst Void:		
22349EN	Canopy tubes, embedded length of reinforcement grouted in place, >0 to 20 ft	Linear foot
22350EN	Canopy tubes, embedded length of reinforcement grouted in place, >20 to 40 ft	Linear foot
22351EN	Self-drilling rock anchors, total embedded length grouted in place, > 0 to 20 ft	Linear foot
22352EN	Self-drilling rock anchors, total embedded length grouted in place, > 20 to 40 ft	Linear foot
22353EN	Steel Rib Support and accessories	Tons

22354EN	Welded Wire Fabric	Square foot
22355EN	Fiberglass Rock bolt, 8ft embedded length grouted in place	Each
Supplemental Support Items:		
22356NN	Supplemental fiberglass Rock Bolt, 10ft Embedded length grouted in place	Each
22357EN	Supplemental fiberglass spiles, total embedded length grouted in place, > 0 to 20 ft	Linear foot
22358EN	Supplemental welded Wire Fabric	Square foot
22359EN	Supplemental steel Rib Support	Ton
22360EN	Supplemental self-drilling rock dowels, total embedded length grouted in place, > 0 to 10 ft	Linear foot
22361EN	Supplemental self-drilling rock dowels, total embedded length grouted in place, > 10 to 20 ft	Linear foot
22362EN	Supplemental self-drilling rock dowels, total embedded length grouted in place, > 20 to 30 ft	Linear foot
22363EN	Supplemental end Anchorage Assembly, self-drilling rock dowels	Each
22364EN	Supplemental Canopy Tubes, embedded length grouted in place >0 to 20ft	Linear foot
22365EN	Supplemental Canopy Tubes, embedded length grouted in place >20 to 40ft	Linear foot
22366NN	Supplemental End Anchorage Assembly, canopy tubes	Each

PART 2 PRODUCTS

2.1 MATERIALS

- A. Maintain on site an adequate supply of rock reinforcement materials to prevent disruption in the Work.
- B. All support elements used for initial support are considered to be permanent for the purposes of this Contract.
- C. Steel rock bolts, and spiles:
 - 1. Rock bolts and spiles shall be continuously deformed steel bars, meeting the requirements of ASTM A615 or A706, Grade 75.
 - 2. Rock bolts and spiles shall be supplied with spin adapters, or otherwise made to facilitate installation.
 - 3. Determine bar lengths based on the embedded length shown on the Contract Drawings and making due allowance required for the end hardware to be installed. Bar diameters shall be as shown on the Contract Drawings. The ends of all bars shall be threaded at least 12 inches to allow placement of nut, and approximately one inch of thread shall project beyond the installed and tightened nut. Tension capacity shall be available through the weakest cross-section at the threads.

4. Bolts and spiles shall have tips shaped as recommended by the manufacturer.
5. Rock bolts shall be furnished with a bearing plate, beveled or spherical washers, and one nut.
6. Bearing plates shall conform to ASTM A36, and meet the load/deflection criteria of ASTM F432.
7. Steel bearing plates against rock shall be a minimum of 3/8-inch thick and have a minimum bearing area of 36 square inches. Bearing plates shall conform to ASTM A36 and meet the load/deflection criteria of ASTM F432.
8. Holes in plate shall be reamed and beveled on the rock side and shall be large enough to permit 30 degree Rock Bolt skew in all directions from normal centerline
9. Nuts shall be hex nuts of the heavy-duty type, shall be compatible with rock bolts, and shall develop at least 125 percent of the minimum yield strength of the element.
10. Beveled, flat, and spherical washers shall conform to the requirements of ASTM F432. Flat or beveled washers shall be two inches minimum round or square and 0.125 inches thick, with the center hole 0.125 inches larger in diameter than the rock bolt with which it will be used.

D. Fiberglass rock bolts or spiles:

1. Shall be fiberglass reinforced plastic as manufactured by one of the following companies, or approved equal:
 - a. H. Weidman AG, CH-8640 Rapperswil, Switzerland, Tel: 41-55-221-41-11, Model: Resinbolt K60-96, 1-inch diameter.
 - b. Willich Fosroc GmbH, Bunnerhelfstrasse 10, D-44379 Dortmund, Germany, Tel: 49-231-96-40-301 Model; Wibolt Star 50, Glass Fibre Rockbolt (Full rod bolt).
 - c. Dywidag-Systems International USA Inc., 320 Marmon Drive, Bolingbrook, IL 60440, Tel: (630) 739-1100, Model: Dywidag Threadbar, 1-inch diameter.
2. Fiberglass face bolts shall be made from polyester resin reinforced with glass fibers in continuous strands. The glass strands shall form 65% to 75% of the weight of the bolt with the balance being resin.
3. Faceplates shall be of dished shape in steel and shall have a hemispherical seating and a centralized slot to suit the dimensions of the different rockbolts. The dimensions of the faceplates shall be (length / thickness): 6 to 8-inch / 0.5 to 1.0-inch, or as designated by manufacturer to match dowel or bolt capacity.
4. Fiberglass rock bolts or spiles shall be ribbed along the full bolt length with a 6-inch long threaded section at the end of bar for faceplate and accessory nuts.
5. The fiberglass shall be reinforced with E-glass fibers and Hybrid Vinylester resin with a minimum of 2.3-percent elongation at break.
6. Unless otherwise shown on the Drawings, the minimum bar dimension shall be 1" plus or minus 1/64-inch in diameter.
7. The guaranteed tensile strength, as defined in ACI 440.1R-01, shall be 145-ksi by ASTM D638 or D3916.
8. Rock bolts shall be furnished with an end plate, beveled or spherical washers, and one nut.

9. End plates shall be minimum 6 to 8-inch square or 6 to 8-inch diameter round glass-reinforced polymer or approved equal.
10. The nuts shall be glass reinforced polymer or approved equal.
11. The breaking load capacity of the end assembly of the fiberglass rock bolts shall be 13.5-kips minimum.
12. Metallic end hardware shall not be permitted on fiberglass rock bolts.

E. Canopy Tubes:

1. Shall be a proprietary brand specifically produced for use as a rock reinforcement or initial support element and shall be manufactured of hollow steel tube with a minimum external diameter of 3.5 inches as manufactured or supplied by one of the following companies or approved equal:
 - a. ALWAG Tunnelausbau Gesellschaft m.b.H.
Wagram 49
4061 PASCHING
AUSTRIA
Mob.TEL: +43 676 906 0971
Web www.alwag.com
 - b. MAI International GMBH, 9710 Feistritz/Drau
Werkstrasse 17
P.O.Box 8 Austria
TEL: +43 (0) 4245/6233-0
2. Canopy tubes shall be steel, black, and conform to ATSM A53.
3. An Arch Canopy shall be installed by drilling the Canopy tubes, consisting of perforated steel pipes, where conditions are considered suitable as agreed with the Engineer suitable into the ground above and ahead of the tunnel face where karst voids are anticipated as shown on the Contract Drawings. The central part of the specialized drill bit can be recovered, the remaining drill bit is left in the ground together with the hollow pipe used as a "sacrificial steel reinforcement tube". Suitable pipe systems are manufactured by Rotex (Symmetric System), Alwag (AT-System), and MAI; they are applied where the crown of the mined tunnel is in decomposed rock, or residual soil, and where karst voids have occurred and spiling is insufficient to provide safety to the mining operations at the excavation face.
4. The nominal center-to-center spacing and longitudinal spacing of individual pipe shall be as shown in the Contract Drawings.
5. Grout Mix Design: Ingredients that are compatible, non-corrosive to steel and free from calcium chloride.
 - a. Cement: ASTM C150, Type I. Cement shall be fresh and shall not contain any lumps or other indication of hydration or "pack set".
 - b. Sand: ASTM C144, except maximum particle size limited to Size 8 sieve.
 - c. Early setting grout required: minimum compressive strength of 100 psi four hours after installation.
 - d. Water: potable, clean and free of injurious quantities of substances known to be harmful to Portland cement.

- F. Admixture and additives: microsilica or other pozzolanic materials; liquefiers; accelerating, retarding and water reducing agents may be used as accepted by the Engineer.
- G. Self-drilling Anchors or spiles:
1. Shall be a proprietary brand specifically produced for use as a rock reinforcement or initial support element and shall be manufactured of hollow steel tube with a minimum external diameter of 1.5 inches as manufactured or supplied by one of the following companies or approved equal:
 - a. Dywidag-Systems International USA Inc., 320 Marmon Drive, Bolingbrook, IL 60440, Tel: (630) 739-1100
 - b. Williams Form Engineering Corporation, 280 Ann St NW, Grand Rapids MI 49510, Tel. (616) 365-9220.
 2. An Arch Canopy shall be installed by drilling the self-drilling grouted anchors where conditions are suitable, as agreed with the Engineer suitable into the ground above and ahead of the tunnel face to enable excavation to proceed where karst voids are anticipated as shown on the Contract Drawings. Presently it is anticipated these anchors will be installed at a lower elevation than the canopy tube ‘umbrella’ over a shorter length of protection to enable incremental excavation to proceed. The central part of the specialized drill bit can be recovered; the remaining drill bit is left in the ground together with the hollow anchor pipe used as a “sacrificial anchor rod”. They are applied where the crown of the mined tunnel is in decomposed rock or residual soil, and spiling is insufficient to provide safety to the mining operations at the excavation face.the anchor rod couplings or deformed thread pipe may be perforated to aid grouting of the bar and the ground in a manner accepted by the Engineer.
 3. The nominal center-to-center spacing and longitudinal spacing of individual self-drilling anchors shall be as shown in the Contract Drawings.
 4. Grout Mix Design: Ingredients that are compatible, non-corrosive to steel and free from calcium chloride.
 - a. Cement: ASTM C150, Type I. Cement shall be fresh and shall not contain any lumps or other indication of hydration or “pack set”.
 - b. Sand: ASTM C144, except maximum particle size limited to Size 8 sieve.
 - c. Early setting grout required: minimum compressive strength of 100 psi four hours after installation.
 - d. Water: potable, clean and free of injurious quantities of substances known to be harmful to Portland cement.
 5. Admixture and additives: microsilica or other pozzolanic materials; liquefiers; accelerating, retarding and water reducing agents may be used as accepted by the Engineer.
- H. Resin Grout:
1. Resin shall be unaffected by mild acids, mild alkalis, or by the formation water. Resin shall reach 80-percent of its ultimate strength within a time interval equal to five times the gel time. Strength of mixed and cured resin when tested in accordance with ASTM C 579 shall be:

- a. Compressive Strength: 17,000-psi
 - b. Tensile Strength: 7,500-psi
 - c. Shear Strength: 4,800-psi
2. Resin shall be supplied in cartridge form, and shall have a casing constructed of saturated polyester providing optimum resistance to moisture, but easily fractured to enable complete mixing during installation.
 3. Resin cartridge shall contain two distinct fractions of unsaturated polyester resin and catalyst with or without an intervening mechanical membrane.
 4. Resin shall be high strength unsaturated polyester with a predominance of non-reactive inorganic filler.
 5. Catalyst shall contain peroxide with non-reactive inorganic filler.
 6. Gel and cure time of fast-set resin shall be sufficient to permit rock bolt tensioning within ten minutes or as recommended by manufacturer for the particular application, but in no case shall the gel time be more than 2 minutes.
 7. Gel time of slow-set resin shall be 20 to 30 minutes.
 8. Resin shall reach 80-percent of ultimate strength within a time interval equal to five times the gel time.
 9. The materials shall have thixotropic and viscous properties to permit adequate mixing of the materials by manipulation of the rock bolts and to prevent the mixture from running out of the hole after mixing.
 10. Resin cartridge shall have a shelf life of not less than six months as dated on the container, and shall be used within that stated shelf life.
 11. Gel and cure time for resin shall permit proper installation in accordance with manufacturers written recommendations.
 12. The cartridges shall be of 12 inches minimum length. A quick setting cartridge (gel time between 2 and 4 minutes) shall be used at the back of all overhead holes to hold the Rock Bolts in place while the slower setting resin sets up. The number of quick setting and slow-setting resin cartridges for Rock Bolts shall be sufficient to develop the anchorage length required.

I. Cement Grout:

1. Cement for grout shall be as specified in Supplemental Specifications Section 31 71 29.
2. Non-shrink Grout shall conform to ASTM C1107.
3. Compressive Strength of the grout shall be not less than 1,000-psi at one day.
4. Cement grout may be one of the following: a) Proprietary pre-packed cartridges with a casing constructed of saturated polyester providing optimum resistance to moisture: b) Proprietary thixotropic pumped grout mix: c) Determine pumped grout of a mix.
5. Where pumped cement grout is used spacers shall be provided to centralize the bar.
6. The cement grout shall completely encapsulate the bar without any air pockets.
7. Pre-packaged cement grout shall be delivered and stored in the manufacturer's original containers. Each container shall be marked with its expiration date. Once grout materials have reached the expiration date they shall not be used and shall be removed from the Work site.

- J. The lubricant for threads and washers shall have a molybdenum disulfide base.
- K. Protective grease shall be factory applied to threads of steel rock bolts, anchors and spiles and entire surface of nuts and washers of steel bolts and their end hardware.
- L. Welded Wire Fabric: Welded wire fabric shall conform to the requirements of ASTM A185 and comply with the wire size and opening shown on the Contract Drawings. Fasteners, where used, to conform to ASTM A313 and ASTM A370.
- M. Rockfall Protection Mesh: Rockfall protection wire mesh shall comply with the requirements indicated on the Contract Drawings. All wire to be used in fabrication and during construction operations is to conform to ASTM A641 and ASTM A975. Fasteners, where used, to conform to ASTM A313 and ASTM A370, as manufactured or supplied by:
Maccaferri Inc., 10303 Governer Lane Boulevard,
Williamsport, MD 21795-3116, Tel: 301-223-6910.
or approved equal.
- N. Steel Ribs and Accessories:
1. Steel ribs shall be wide flange shapes conforming to requirements of Section 1.8 and to the minimum section size and shape shown on the Contract Drawings.
 2. A supply of steel ribs for the tunnel shall be manufactured and delivered to the Work site before commencing the tunnel drives. The number of steel ribs kept stored on site shall be accepted by the Engineer and shall be such that a further supply of steel ribs can be obtained before the stored stock is exhausted, and no disruption results to the tunnel progress. When, accepted by the Engineer, the excavation is sufficiently complete that such quantity is not necessary, the quantity may be reduced as directed.
 3. Steel ribs and associated initial support steelwork shall be structural steel conforming to ASTM A36. Bolts shall conform to ASTM A325. Steel ribs shall be furnished complete with bolts, nuts, washers, plates, tie rods, spreaders and other accessories required for installing the ribs.
- O. Blocking: All timber for blocking shall be oak or equivalent wood acceptable to the Engineer.

2.2 STORAGE AND PROTECTION

- A. Store and protect all rock reinforcement and initial support materials in accordance with the manufacturer's recommendations and in a manner that prevents damage or deterioration.

PART 3 EXECUTION

3.1 GENERAL

- A. The Initial Support Elements shall be installed in the combinations as shown on the Contract Drawings, as specified herein, or as directed by the Engineer.

- B. Determine prior to excavation in tunnels the system of initial support that is likely to be the most suitable for the excavation in accordance with the known and probable behavior of the rock material to be excavated so that the appropriate rock reinforcement elements can be provided for immediate installation should this become necessary.
- C. Immediately after each advance excavation cycle or blast, determine the initial support class to be installed in accordance with the accepted Support Selection Procedure by undertaking mapping and assessment of the exposed ground conditions, with the Engineer present. As required in the Geotechnical Baseline Report, Section 7.5, recommend type of initial support system to be installed based on the assessed and recorded ground conditions for review and confirmation by the Engineer. Install this initial support system and any other support that may be deemed necessary taking into account Contractor's obligation for safety of the Work, persons and equipment, technical requirements of the Engineer, optimization of construction time and economy of construction. The initial support system recommended shall only be varied with the acceptance of the Engineer to suit the ground conditions encountered.
- D. Submit the ground assessment record immediately after completion of the assessment to the Engineer.
- E. When the initial support system recommended requires shotcrete, the placement of shotcrete shall not proceed until the completion of the required geological mapping and appropriate tunnel photography for geotechnical assessment purposes, to the Engineer's Satisfaction.
- F. Notwithstanding any decision taken in this regard by the Contractor, the Engineer reserves the right to order supplemental initial support elements installed at any location in the underground Work without relieving the Contractor of his responsibilities in terms of the Contract.
- G. Installation of initial support shall follow the excavation phase without disruption. If necessary, it shall be done before or in conjunction with mucking operations.
- H. Rock bolt and welded wire fabric installation in the Exploratory Tunnel shall be kept to within 4 feet of the face before the next round is blasted; in the exploration bays, rock bolt and welded wire fabric installation shall be kept within 3 feet of any face, or adjacent excavation enlargement of the bay width, prior to the next round being blasted. In no case shall rock bolt installation lag more than 12 hours after excavation blasting.
- I. Install initial support elements in accordance with the accepted initial support submittal to give rock reinforcement that is adequate to ensure the stability of the opening.
- J. Maintain all initial support systems and supplemental support throughout the length of the Contract. Periodically inspect all exposed rock areas in the excavations and install additional initial support, as required.

- K. In an emergency that is likely to endanger the excavation, employ a full workforce for 24 hours a day including weekends and holidays without intermission until the emergency or hazardous conditions no longer jeopardize the stability and safety of the Work.
- L. Where the installation of welded wire fabric or mesh, rock bolts or self drilling anchors is done simultaneously, the welded wire fabric or mesh shall be placed over the elements between the rock surface and the steel bearing plate. The rock reinforcement shall be tightened to draw the welded wire fabric or mesh tightly to the rock surface.
- M. Where welded wire fabric is used, overlaps of 1-1/2 times the mesh spacing shall be provided at joints. Width of fabric shall be coordinated with the anchor installation pattern. The fabric shall not be lapped at intermediate points. Pins for supporting welded wire fabric at intermediate points may be used and shall be suitable commercially available fiberglass bars with resin anchors. These pins shall be 3/4-inch in minimum diameter and of one-foot minimum length to extend approximately one foot into sound rock with enough projection from the rock for the proper attachment of the fabric with bearing plates.
- N. Welded wire fabric or mesh shall be firmly secured so that it follows closely the approximate contour of the rock.
- O. For mechanically anchored reinforcements, holes are to be drilled in the rock to the proper depth and diameter to give the optimum anchorage for the type of anchor being used.
- P. Holes shall be drilled to the pattern shown on the Contract Drawings or dictated by actual rock conditions.
- Q. For steel rock bolts, or spiles any protective grease shall be removed from bars, washers, and nuts with a suitable non-toxic solvent. Lubricant shall be applied to the exposed end threads being careful to keep the portion to be embedded free from all grease, lubricant, and contamination. Threads shall not be contaminated during installation.
- R. Bearing plates are to be set nearly flat against the rock face with the bearing surface of the nut perpendicular to the rock bolt or pins as practicable. Lubricant shall be applied between the washer and nut. Flat washers immediately under nuts shall be maintained perpendicular to Rock Bolts or pins by the use of a beveled washer or washers between said flat washers and bearing plates. The bearing surface of all nuts shall be flat against the washer by the use of beveled or spherical washers. Prior to covering the rock bolts or pins all lubricant shall be removed using a suitable non-toxic solvent.
1. Rockbolts shall have adequate end bearing plate force against the substrate during installation per the manufacturer's instruction and to ensure an adequate attachment of the weld wire fabric to the rock surface.
- S. Adequate supply of support elements shall be maintained on the site to prevent disruption in the Work. The supply shall include rock bolts, fabric pins, spiles, self-drilling anchors, steel arch ribs, end hardware, cement grouts, resin cartridges, and miscellaneous steel.

- T. Drill holes to the required depth and diameter in accordance with the appropriate manufacturer's recommendations and as confirmed by trials. Holes for rock bolts shall be of greater diameter than the nominal diameter of the bolt. Holes shall be drilled generally perpendicular to the excavated surface.
- U. Clean holes of drill cuttings, sludge and debris before installing cartridges or bolts.
- V. Review by the Engineer of any support systems installed shall not relieve Contractor's responsibility for the adequacy and safety of the installed support systems, safety of the Work, or producing the end results required by these Specifications.

3.2 INSTALLATION OF RESIN GROUTED ROCK SPILES

- A. Percussion drill the hole for each rock spile in accordance with the type of initial support as shown on the Contract Drawings to a uniform diameter recommended by the manufacturer for the entire length. The borehole must be compatible with the diameter of the rock bolt and the specified grouting method.
- B. Resin-anchored Rock Spiles shall be installed in accordance with the manufacturer's recommendations by inserting the type and number of resin cartridges into the drilled hole for the anchorage conditions. Care shall be taken to avoid premature rupture of the cartridge skin.
- C. The Rock Spile shall be inserted into the hole, to rupture the cartridge and mix the resin, by rotating it through the cartridge.
- D. The Rock Spile shall be rotated for 5 to 10 seconds after the Rock spile reaches the bottom of the hole or for a minimum of 20 seconds total, whichever is less.
- E. Sufficient resin grout cartridges shall be used at the time of installation of the elements so that the element is anchored and totally encapsulated with resin grout after insertion and rotation of the element.

3.3 INSTALLATION OF CEMENT GROUTED ROCK SPILES

- A. Percussion drill the hole for each rock spile in accordance with the type of initial support as shown on the Contract Drawings to a uniform diameter recommended by the manufacturer for the entire length. The borehole must be compatible with the diameter of the rock bolt and the specified grouting method
- B. For cement-grouted spiles, the method of grouting shall be one of the following:
 - 1. Fill the hole with grout of sufficient viscosity that it does not run out of the hole by inserting a hose to the full depth of the hole and allowing the hose to be pushed out by the grout as the grout fills the hole, following which insert the dowel with faceplate fitted into the hole and wedge it in place while the grout sets; or
 - 2. The spile shall be fitted with grout and vent tubes securely taped to the spile terminating near the top and bottom of the hole. The spile with faceplate fitted

shall be inserted into the hole and held in place by either a mechanical anchorage or wedges and the faceplate sealed to the rock face with mortar or other means to prevent leakage of grout. Grout shall be injected through the grout tube, which terminates near the lower end of the hole until a return flow of grout is observed in the vent tube, which terminates at the upper end of the hole. The tubes shall be sealed to prevent escape of grout before disconnecting from the grout pump. Grouting shall be performed in a continuous operation, and if the continuity of injecting grout is interrupted the grout shall be flushed out and grouting restarted: or

3. Grout cartridges shall be inserted into the predrilled hole and the spile together with the faceplate inserted into the hole and wedged in place until the grout has set.
4. Tighten faceplates after the grout has set, to a torque corresponding with 50 percent of the working capacity specified or shown on the Drawings.

C. For cement grouted spiles the method of grouting shall be one of the following:

1. Fill the hole with grout of sufficient viscosity that it does not run out of the hole by inserting a hose to the full depth of the hole and allowing the hose to be pushed out by the grout as the grout fills the hole, following which insert the spile into the hole and wedge it in place while the grout sets; or
2. Grout cartridges shall be inserted into the predrilled hole and the spile inserted into the hole and wedged in place until the grout has set

D. For self-drilling anchors grouting shall be undertaken using the equipment and methods as recommended by the manufacturer. Grout shall be injected through the anchor until grout is seen around the anchor at the entrance to the hole at which point the annular space will be blocked using appropriate materials and grouting shall continue until the anchor is completely encased.

3.4 INSTALLATION OF CEMENT GROUTED MECHANICALLY ANCHORED ROCK BOLTS

- A. Percussion drill the hole for each rock bolt in accordance with the type of initial support as shown on the Contract Drawings to a uniform diameter recommended by the manufacturer for the entire length. The borehole must be compatible with the diameter of the rock bolt and the specified grouting method.
- B. Install bolt and expand mechanical anchor to required torque value.
- C. Pack or seal holes between the end plate and rock to retain the grout in the hole.
- D. Mechanically anchored rock bolts shall be fully grouted after completion of tensioning.

3.5 INSTALLATION OF RESIN GROUTED ROCK BOLTS

- A. Resin grouted Rock Bolts shall be installed in accordance with the manufacturer's recommendations.

- B. Percussion drill the hole for each rock bolt in accordance with the type of initial support as shown on the Contract Drawings to a uniform diameter recommended by the manufacturer for the entire length. The borehole must be compatible with the diameter of the rock bolt and the cartridge diameter specified.
- C. After drilling and cleaning of rock holes has been completed insert the type and number of resin cartridges into the drilled hole for the anchorage conditions. Care shall be taken to avoid premature rupture of the cartridge skin.
- D. The Rock Bolt shall be inserted into the hole, to rupture the cartridge and mix the resin, by rotating it through the cartridge.
- E. The Rock Bolt shall be rotated for 5 to 10 seconds after the Rock Bolt reaches the bottom of the hole or for a minimum of 20 seconds total, whichever is less.
- F. Resin grout cartridges with one or more gel set times shall be used in order to obtain anchorage in the rock.
- G. Sufficient resin grout cartridges shall be used at the time of installation of the rock bolts so that it is anchored and totally encapsulated with resin grout after insertion and rotation of the rock bolt.
- H. Ensure that the resin does not run out of the hole. Promptly clean any excess resin from any surface that will receive shotcrete.
- I. Use of the manufacturer's recommendations does not relieve the Contractor of responsibility to provide a bolt of the required capacity with complete encapsulation.
- J. Rock bolts will typically be installed in general accordance with ASTM D-4435, as amended by these Specifications

3.6 TENSIONING ROCK BOLTS

- A. Steel Rock Bolts:
 - 1. Tension the rock bolt by direct pull using center-hole hydraulic jacks and accurate calibrating techniques to 60-percent of the bolt yield strength, and the nut tightened to retain the bolt tension. If the bolts are resin-encapsulated, do not begin tensioning until the fast gelling anchor cartridges have reached their working strength as determined from certified tests by the manufacturer for the approximate temperature at which installation occurs. Complete tensioning before gelling of the remaining cartridges begins. Upon completion of the tensioning, lock the force by tightening the nut using the 1/4-turn method.
 - 2. When tension is being applied, operators shall stand to the side of the equipment and no one shall stand in line with the bolt.
 - 3. After tensioning of the bolt has been completed, do not relax the tension for any purpose.

3.7 IN-PLACE PULL TESTS FOR ROCK BOLTS

- A. Perform pullout tests; the Engineer may be present.
- B. Provide equipment to be used for performing pullout tests and maintained in good working condition.
- C. Store equipment in a secure, dry area.
- D. Pullout test equipment shall consist of:
 - 1. A suitably sized hollow ram jack
 - 2. An adjustable bearing truss for aligning the direction of pull with the centerline of bolt.
 - 3. A 12" x 12" x ½" bearing plate placed between the rock surface and the bearing truss to limit rock deflections
 - 4. An extension bar for attaching the jack to the bolt a hydraulic pump with a gauge calibrated to read directly in pounds per square inch for the ram being used
 - 5. A dial gauge which reads in increments of 0.001 inch over a range of 2 inches
 - 6. A magnetic or independent dial gauge mounting
 - 7. A load cell and readout
 - 8. All other necessary accessories
- E. To assure that the bolt is allowed to stress the epoxy/rock contact, the frame used by the Contractor shall not bear directly on the epoxy, i.e., the circular or cylindrical portion of the frame that bears on the rock must be larger than the diameter of the hole. The surface of the bolt, which contacts the dial indicator probe shall be machined or ground to a smooth flat surface, perpendicular to the axis of the bolt.
- F. The hydraulic pump gauge shall be calibrated with the load cell while connected to the jack, by a uniaxial testing machine prior to performing pullout tests. The hydraulic pump gauge shall be re-calibrated at subsequent times as directed by the Engineer during the period of construction.
- G. To prevent disruptions in the Work, spare parts shall be kept in stock for testing equipment, especially for the gauges and pump seals.
- H. Pre-production Testing: Pre-production testing will be performed to verify that the equipment, procedures, and materials to be used during production operations will result in rock bolts anchors that satisfy the performance criteria.
 - 1. Furnish and install four rock bolts that are not part of the initial support system, at a location agreed with the Engineer.
 - 2. Rock bolts shall be installed in accordance with these Specifications, using the same materials, equipment and personnel that will be used for production rock bolts and dowels.
 - 3. Rock bolts shall be installed as follows: two in the tunnel crown and two in the sidewall with an inclination above horizontal. Two bolts shall be loaded to failure, which in this case is defined as the point at which axial deformation increases with no increase in applied load.

4. The remaining two bolts shall be tested as specified herein.
 5. Should any of the four bolts tested under this Article fail a minimum of one additional bolt shall be installed and tested, for each element that fails, until failures no longer occur
- I. Production rock bolt or dowel testing:
1. Rock bolts shall be load tested as specified herein.
 2. Initially one out of each twenty installed bolts or dowels shall be load tested. If the test fails two additional elements will be tested. If either of these two additional bolts or dowels fails, all of the remaining elements represented by the test sample will be tested.
 3. Replace any bolt that fails to meet the load test criteria. Any replacement bolt installed will be tested to ensure satisfactory installation.
 4. The initial frequency of load testing will be reduced upon successful demonstration of consistent compliance with specified requirements. In this case consistent compliance is defined as no failures in a minimum of 10 load tests. Once consistent compliance has been achieved the testing frequency will be reduced to one in 100 installed bolts or dowels. Should any bolts or dowels fail the testing frequency shall revert to 1 in 20 production bolts or dowels until the previously defined consistency has been re-established
- J. Load Test Procedure: Load the rock bolt or dowel to the designated load in increments as indicated. Each load increment shall be held for the specified durations. Elongation of the bolt shall be measured for each increment. Failure is defined as any rock bolt exceeding the allowed elongation during the final hold period at the maximum load.
- K. Steel Rock Bolts and Dowels Load Test Requirements:
1. Maximum load = 80% of ultimate yield strength
 2. Hold Period = 5 minutes
 3. Increments = 4
 4. Elongation = 0.5 inch
- L. Fiberglass Rock Bolts Load Test Requirements:
1. Maximum load = 18 kips
 2. Hold Period = 5 minutes
 3. Increments = 4
 4. Elongation = 0.5 inch
- M. The results of rock bolt tests shall be submitted to the Engineer within 24 hours of the completion of each test or inspection.
- N. As the excavation is anticipated to expose three main rock types: Upper Limestone, Waldron Shale and Laurel Dolomite, as described in the GBR, the load tests for fiberglass rock bolts shall be tested initially in the upper limestone as per paragraph 3.7.H above, and shall be repeated in the two other rock types at locations within the tunnel designated by the Engineer.

3.8 PLACEMENT OF WELDED WIRE FABRIC (WWF)

- A. Welded wire fabric shall be placed and secured against the excavated or shotcreted surface as shown on the Contract Drawings. The fabric shall be anchored to follow the excavated or shotcreted surface contours and additional pins shall be provided if necessary to hold WWF in contact with the excavated surface or shotcrete.
- B. Welded wire fabric shall not be used with fiber-reinforced shotcrete.

3.9 PLACEMENT OF ROCKFALL PROTECTION MESH

- A. Rockfall protection mesh shall be placed and secured against the excavated rock surface as shown on the Contract Drawings. The mesh shall be anchored to follow the excavated surface and additional pins or shall be provided if necessary to hold the mesh in contact with the excavated surface.
- B. Selvedges: All edges of the rockfall protection mesh shall be mechanically selvedged in such a way as to prevent unraveling of the fabric and to develop the full strength of the fabric. The wire used for the selvedge shall have a diameter greater than that of the wire used to form the mesh.
- C. Lacing: Adjacent panels of wire mesh shall be laced together by securing one end of the lacing wire to the mesh by looping and twisting, alternately lacing with single and double loops every other mesh opening at intervals of not more than 6 inches, and securing the other end of the wire to selvedges by looping and twisting. The lacing wire shall be cut to a length $1\frac{1}{2}$ times the distance to be laced, not to exceed 5 feet.
- D. Fasteners: As an alternative to lacing wire, stainless steel fastening rings may be used to join the mesh panels. Fastener spacing shall not exceed 6 inches. The diameter of the rings shall be the same as the mesh.

3.10 INSTALLATION OF STEEL RIBS

- A. Install steel ribs in accordance with the Drawings and to give support that is adequate to ensure the stability of the opening.
- B. Maintain the ribs in the proper condition and within tolerances for alignment throughout the duration of this Contract.
- C. Ribs that are improperly installed, damaged, or displaced, shall be repaired or replaced within 48 hours after notification by the Engineer
- D. Blocking:
 - 1. Steel ribs shall be securely blocked and braced against rock surfaces, and against distortion and lateral displacement.
 - 2. Place blocking in the form of open cribbing. Cribbing shall be arranged to permit the ready flow of future final lining concrete through and around cribbing

END OF SECTION



**Louisville Southern Indiana Ohio River Bridges Project,
Kentucky East End Approach Tunnels**

**Geotechnical Baseline Report
Exploratory Tunnel**

July, 2007

Louisville-Southern Indiana Ohio River Bridges Project

SECTION 4B EXPLORATORY TUNNEL

GEOTECHNICAL BASELINE REPORT EXPLORATORY TUNNEL



Prepared by:



For:

Kentucky Transportation Cabinet

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- A. Geologic Description

1 INTRODUCTION

The Louisville Southern Indiana Ohio River Bridges (LSIORB) Project is being developed to improve cross-river mobility between Jefferson County, Kentucky and Clark County, Indiana. Section 4, one of six sections, is the East End Kentucky Approach and Connections to I-265. A key element of Section 4 is twin three-lane highway tunnels under the historic Drumanard Estate. The property is located on the north side of US Highway 42 (US 42) at the intersection with the Gene Snyder Freeway (also KY 841), as shown on Figure 1. This Contract consists of the excavation of an Exploratory Tunnel along the southbound alignment. The findings from the Exploratory Tunnel will be incorporated into the design of the twin tunnels to be constructed under a future contract.

The Indiana Department of Transportation (INDOT) and the Kentucky Transportation Cabinet (KYTC) are developing the LSIORB Project jointly, in coordination with the Federal Highway Administration (FHWA). Hatch Mott MacDonald (HMM) prepared this Geotechnical Baseline Report (GBR), the associated Geotechnical Data Report (GDR), and other Contract Documents for the Exploratory Tunnel under subcontract to H.W. Lochner (HWL), prime consultant for Section 4. Fuller, Mossbarger, Scott, and May Engineers, Inc (FMSM) performed field investigations for the Exploratory Tunnel, with assistance from HMM.

This GBR provides a baseline description of the anticipated subsurface conditions to be encountered during excavation of the Exploratory Tunnel; provides the basis for selection of initial support of the tunnel; and describes exploration and testing activities to be carried out during the work. The GBR is intended to assist bidders in evaluating the requirements for excavating and supporting the ground, controlling groundwater inflows, and identifying other important construction considerations.

Risks associated with subsurface conditions consistent with, or less adverse than, the baseline conditions represented in this GBR are allocated to the Contractor. Those risks associated with subsurface conditions more adverse than the baseline conditions are accepted by the Owner. The baseline conditions represent a contractual standard that the Owner and the Contractor agree to use when administering Subsection 104.02.03-Differing Site Conditions of Division 100-General Provisions, Standard Specifications for Road and Bridge Construction, Edition of 2004, KYTC.

This report presents the design team's best judgement of soil, rock and groundwater conditions expected to be encountered in the surface and subsurface excavations for the Exploratory Tunnel. While the actual conditions encountered in the field are expected to be within the ranges discussed, the actual conditions encountered will likely vary from those presented in this report. The behavior of the geologic materials encountered in the surface and subsurface excavations will be influenced by the Contractor's selected equipment, means, methods, and level of workmanship.

It is highly recommended that Bidders engage a geotechnical engineer or engineering geologist to review thoroughly this GBR so that a complete understanding of the information presented in this report can be developed prior to submitting a bid.

Certain elements of the Contract are based on requirements that cannot be varied. These include, but are not limited to, the following:

1. Ground support elements and unsupported length from the face as shown or noted on the Contract Drawings;

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2. Invert protection where shale is exposed in the tunnel invert as shown or noted on the Contract Drawings;
 3. Probe hole and associated water pressure testing to be carried out in advance of excavation;
 4. Locations, dimensions, and the concurrent excavation of the exploration bays while the tunnel heading is advanced, to facilitate timely geotechnical investigations within the tunnel;
 5. Spoil removal from the site as shown on the Contract Drawings;
 6. Removal and treatment requirements for groundwater and construction water;
 7. Access of the Engineer or his designated personnel to carry out mapping or geotechnical monitoring of exposed excavation surfaces;
 8. All geotechnical investigation activities to be performed within the exploratory tunnel;
 9. Limitations on allowable working hours; and
 10. Limitations on blasting and vibration levels as defined.

A number of elements of the Contract are flexible, and afford the Contractor latitude in the selection of layout geometries, construction methods, equipment, and procedures, which are subject to the approval of the Engineer, and at no additional cost to the Cabinet. These include, but are not limited to, the following:

- Increased excavated width of the Exploratory Tunnel;
- Lowering of the tunnel invert; and
- Method of excavation (excluding TBM).

Any changes made by the Contractor for his own convenience or benefit shall be at the Contractor's own expense.

Certain drawings and figures contained in other documents in the Contract are referenced by the GBR as an aid to Bidders in understanding the elements of the work. Such drawings are not reproduced in the GBR.

2 CONTRACT DESCRIPTION

2.1 Introduction

The tunnel portion of Section 4 is oriented in a north-south direction near the City of Prospect, Kentucky. Access to the Exploratory Tunnel will be via an access ramp and a deep rock cut located at the southeastern end of the Contract site. The cut and access ramp is outside the scope of this GBR.

2.2 Access Ramp

Prior to the Exploratory Tunnel access ramp construction, the existing KY 841 off-ramp is to be relocated by others to a position adjacent to the existing KY 841 on-ramp. The relocated KY 841 off-ramp will provide access and egress for haulage trucks for removal of tunnel spoil from the Contractor's working area, and will continue to provide access to US 42.

The site access to the Exploratory Tunnel Contractor's working area will be located at the former junction of the KY 841 off-ramp with US 42. The Contract Drawings illustrate the manner in which the Contractor will access and egress from the intersection area, and where the work can be staged. Access to the Exploratory Tunnel involves a downgrade as shown on the Contract Drawings.

2.3 Exploratory Tunnel

The Exploratory Tunnel will be 1,800 feet long, with a nominal cross-section measuring 12.3 feet high and 12.5 feet wide, as shown on Contract Drawings C-001 and C-007. The Exploratory Tunnel will be excavated within the future southbound highway tunnel through sedimentary rock formations consisting of limestones, shales, and dolomites. The limestones are known to exhibit karstic features resulting from the passage of water through soluble rock materials, leaving open and soil-filled channels in the rock mass. A total of four exploration bays will be excavated into the right (eastern) sidewall of the Exploratory Tunnel at the locations shown on Contract Drawings C-001 through C-006.

From the tunnel portal at Southbound Tunnel Station (SB) 50+00, the Exploratory Tunnel will trend northward at a 2.52% downward grade, cross beneath US 42, and then cross beneath the Drumanard Estate. The Exploratory Tunnel excavation shall not be permitted to daylight at its north end, but will terminate at SB 68+00. Therefore, the south portal will comprise the only access to the underground works.

Site investigations to be carried out by the Engineer and Contractor within the Exploratory Tunnel are described in Section 02 32 12 – Geotechnical Investigation in Exploratory Tunnel, of the Exploratory Tunnel Supplemental Specifications and shown on the Contract Drawings GI-01 through GI-12. The activities will include, but are not limited to, the following:

- A geologic mapping program throughout the Exploratory Tunnel. This work will be carried out through a combination of visual mapping, digital scanning survey of all excavated surfaces, and photo documentation.
- Observations regarding groundwater flow in and through the rock mass, and observed effects, on the regional groundwater table and on the ground surface.

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- In situ measurements of rock properties, including slake durability.
 - The recovery of rock samples for subsequent laboratory testing.
 - Geophysical tests to investigate karstic void features within the rock mass, both within the tunnel and on the ground surface.

In addition, surface drilling of additional boreholes to install piezometers and extensometers at selected locations above the tunnel alignment will also be conducted.

Subsurface and surface investigations require the following work to be performed by the Contractor:

- An instrumentation program consisting of extensometers installed underground and surface measurements utilizing prismatic survey targets linked to robotic total station systems. The Exploratory Tunnel Supplemental Specifications also include the alternative of installing a series of robust survey stations on which theodolites can be re-established with precision. Such stations will also form the basis for the positioning of the digital scanning system, where used, for geologic mapping.
- Modification of existing standpipe wells to accommodate piezometers;
- Installation of piezometers within the exploratory tunnel and exploration bays
- Installation of tunnel convergence arrays
- Installation of rod extensometers within the exploratory tunnel and exploration bays
- Installation of cyclical wetting and drying chambers of Waldron shale in selected exploration bays
- Installation and testing of rock bolts under pull out loads
- Installation of flow gauge instruments in existing stream courses
- Installation of settlement monitoring points throughout the alignment to monitor any movements that could effect existing structures or utilities
- Survey monitoring to confirm stability of portal and tunneling beneath US 42.
- Drilling of investigation holes from the portal face

3 SOURCES OF GEOLOGIC INFORMATION

The primary sources of geotechnical data used in identifying and describing anticipated physical site conditions were exploration and testing that were completed specifically for the Contract. These included borings, surface mapping, surface geophysics, field tests, and laboratory tests. In addition, the following references and sources of information were reviewed:

1. *Final Environmental Impact Statement (FEIS)*, signed by the Federal Highway Administration, Indiana Department of Transportation, Kentucky Transportation Cabinet, 2003.
2. Louisville-Southern Indiana Ohio River Bridges Project Section 4 - East End Kentucky Approach and I-265 Connections; Geotechnical Data Report, May 2006.

The principal sources of published information are two geologic maps of the region by Sparks and Zhang (2003) and Kepferle (1974). These show the bedrock outcrop locations, provide a description of the mapped units and the overall structural geologic setting, including the location of the Springdale anticline some 3 miles southwest of the planned tunnel site.

As will be discussed in later sections, two of the three formation units through which the tunnel is to be excavated, and other geologic units above and below the tunnel, exhibit karst. The published sources for evidence of karst in the region comprise:

1. Groundwater Resources of Jefferson County, Kentucky, Carey, D. and Stickney, County Report 56, Series XII ISSN) 75-5567, 2005.
2. Karst occurrence in Kentucky, 1:500000 map Paylor, R. and Currens, J. Map and Chart 33 Series XII, 2001, KGS, UKY, Lexington, KY.
3. Groundwater sensitivity regions of Kentucky, 1:500000 map and associated interpretation report, Kentucky Department For Environmental Protection, Division of water – Groundwater Branch, 1994.

3.1 Overview of Investigation Program

3.1.1 Borings

A total of 18 borings, labeled B-1 through B-18, have been performed to date in the vicinity of the future tunnels and the Exploratory Tunnel. Figure 1 indicates the location of the ten borings which are directly offset from the Contract alignment in the following sequence, progressing from south to north: B-15, B-12, B-3, B-11, B-10, B-9, B-8, B-5, B-6, and B-7, together with B-16 some 300-feet south of the South Portal and B-2, B-14 and B-1 which lie at or within 300-feet north of the planned north portal of the future tunnels. The remaining four borings B-4, B-13, B-17 and B-18 lie 300-feet beyond the immediate vicinity of the Exploratory Tunnel located in the planned highway approach cuts. The boring logs and a plan and profile containing stick logs, are contained in the GDR.

3.1.2 Field and Laboratory Testing

In situ field permeability packer tests were carried out in borings B-15, B-11, B-9, B-8, B-6, B-5, and B-7. Testing of soil and rock samples was performed for the Contract. The data is presented in the GDR. Selected test results are summarized in this report in tables, or other forms where needed to substantiate characterization and behavior.

3.1.3 Surface Geophysics

Geophysical surveys were performed at the planned portal locations of the future tunnels. The following imaging technologies were employed:

- Conventional seismic refraction
- Gravity
- Self-potential
- Ground-penetrating radar
- Electrical resistivity
- Multi-channel surface wave analysis

The methods, results and data from these studies have been incorporated into profiles, descriptions and other aspects of the data interpretation and are described in the GDR.

Two of these surface-based methods, seismic refraction tomography and electric resistivity, will be utilized during the Exploratory Tunnel to further investigate the site. Additionally, electrical resistivity surveys will be carried out within the Exploratory Tunnel to investigate the nature of the ground beneath the Exploratory Tunnel invert.

The Contract Documents call for the Contractor to provide access and support services to specialist geophysical sub-contractors to carry out tests along the invert of the tunnel in two phases, in the locations shown on Contract Drawing GP-001.

3.1.4 Televiewer and Downhole Geophysical Surveying

A down-hole borehole televiewer and geophysical surveys were performed in boreholes B-5, B-6, B-8, B-10, and B-11. Record logs of traverses using optical televiewer, 4-pi density, neutron, and 3-arm caliper tools in each of the five boreholes have been produced together with stereonet and rose plots of interpreted fracture/bedding orientation, tabulation of individual fracture/bedding orientation, and optical televiewer logs. The methods, results and data from these studies are described in the GDR.

4 GEOLOGIC SETTING

4.1 Regional Geology

The Exploratory Tunnel alignment is located near the northern boundary of Jefferson County beneath rolling topography with ground surface elevations ranging from 515 feet to 595 feet above mean sea level (MSL). The site is located about one mile southeast of the Ohio River, which has an elevation of approximately 420 feet near the confluence with Harrods Creek. In general, the ground elevations are higher in the southern half of the alignment near US 42 and decrease towards the north. The topography along the Exploratory Tunnel alignment is shown on Contract Drawings C-001 through C-006.

As presented in various Kentucky Geological Survey documents, the Exploratory Tunnel and the future tunnels are located in the Outer Bluegrass Physiographic Province. In the Contract area, steep sloped hills and valleys covered with a veneer of residual soil and underlain by interbedded shale and limestone/dolomite layers characterize this Province. The Contract area is also located along the northeastern edge of the Cincinnati Arch, an area of regional uplift such that the limestone and shale layers dip (tilt) gently downwards towards the north-northwest at an angle of less than 10 degrees from horizontal. Refer to the GDR for additional discussion.

4.2 Regional Soil Conditions

According to a Soil Survey of Jefferson County, Kentucky (Zimmerman, 1966) the soils across the Contract site belong to the Crider Series. They are reported as: “well-drained soils found in sinks and on wide, level ridges with short side slopes.” The upper 30 inches is comprised primarily of loess (windblown silt) and the underlying material formed primarily as residuum from the parent limestone. The thickness of the overburden soils is reported in the reference to range from 3 feet to 14 feet.

However, as discussed in the GDR, this layer of loess, reportedly up to 30 inches thick, could not be distinguished within the site borings conducted on the Drumanard Estate. This survey concluded the soils encountered in boring B-6, namely soft to stiff lean clay and silt with trace to some sand and fine gravel, could be taken as representative of soils within the Drumanard Estate. Equally, the GDR concluded the soils observed along the Contract alignment did not appear as well drained as reported in the references, and ponding of water at surface following rains or snow melt-off was observed.

4.3 Regional Rock Types

Rock was encountered in the borings advanced for the Exploratory Tunnel. The rock formations encountered in the borings are presented in order from the shallowest to deepest and include:

- Jeffersonville/Sellersburg Limestone (Undifferentiated)¹
- Louisville Limestone¹
- Waldron Shale
- Laurel Dolomite
- Osgood Formation
- Brassfield Limestone
- Saluda Dolomite Member of the Drakes Formation

¹ Comprise Upper Limestones

Only the Louisville Limestone, the Waldron Shale, and the Laurel Dolomite (at the northern end of the alignment) will be encountered in the Exploratory Tunnel excavations.

Details, including the borehole logs of core drilling of these rock types, are provided in the GDR. Core recovery will be required in these rocks from the boreholes scheduled in the Contract. Summary descriptions of the rock units from Sparks and Zhang (2003) are given in Appendix A. Of particular mention, Sparks and Zhang (2003) comment that:

“Slope instability in the shale-dominant units affects construction and engineering projects. The high clay content in the Waldron Shale, Osgood Formation, ... can lead to foundation failure under roads and buildings. Water saturation will cause the clay minerals in these shales to shrink and swell, which results in heaving and movement of sediments. Roads built on these sediments should have adequate drainage to channel water away, and buildings may need pilings down to bedrock. Slope cuts should not be over-steepened, because these clay-rich units are prone to slumping. The clay content renders the soil relatively impermeable, and percolation rates are too low for adequate septic-tank drainage.”

Measures to cope with these shale-dominant units are described later in this report.

4.4 Bedrock Profile and Karst

The location of the Exploratory Tunnel and adjacent area is known to be prone to karstic development. Paylor and Currens (2002) define the term karst as, “a terrain that is generally underlain by limestone or dolomite, where the topography is formed mainly by dissolving rock. Karst landscapes are commonly characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, large springs, and caves.” According to their geologic map of Karst Occurrence in Kentucky, the location of the Exploratory Tunnel and immediately adjacent areas are, “underlain by bedrock with high potential for karst development.”

Other published works exist which suggest that the Contract site is prone to karst development. Carey and Stickney (2005) define the area surrounding the Contract site as karst prone. Likewise, other sources suggest karst features. For example, Sparks and Zhang (2003) state that sinkholes occur occasionally in the Louisville Limestone and Laurel Dolomite; Kepferle et al. (1971) also state that sinks develop in the Louisville Limestone on uplands.

4.5 Hydrogeologic Setting

In the vicinity of the Contract area, the notes of Hydrogeology in Geologic Map of the Louisville 30 x 60 minute Quadrangle (Thomas Sparks and Qinhu Zhang Geologic Map 4 Series Xii, 2003, UKY KGS) note:

“Most groundwater in the Louisville Quadrangle is obtained from wells less than 100 feet deep in shallow alluvial deposits or fractured bedrock. Some Ohio River alluvial wells in Jefferson and Oldham counties may produce as much as 1000 gallons per minute. Springs are common in many of the carbonate units in the area, such as Louisville Limestone, Laurel Dolomite, and Drakes formation”

Alluvial deposits adjacent to the Ohio River, such as those referenced above, near the mouth of Harrods Creek have surface elevations of 430 feet to 440 feet, on the order of 50 feet below the lowest invert elevation of the Exploratory Tunnel.

As noted in (Kepferle, 1974) water from wells in the limestone is highly mineralized; calcium carbonate concentrations average about 580 parts per million (ppm) and with sulfates average about 450 ppm. No groundwater sampling or chemical testing has been conducted in the current investigation program.

The area of the tunnel alignment has been categorized as having a Hydrogeologic Sensitivity Rating of 4, on a scale ranging from 1 (low) through 5 (high) (Ray et al, 1994), which defines the ease and speed with which a (waterborne or liquid phase) contaminant can move into and within a groundwater system.

This information indicates that there is a high potential for hydraulic conductivity and that infiltration will increase due to localized rainfall runoff or stream catchment flow.

4.6 Tectonic Setting

The U.S. Geological Survey (USGS) seismic risk maps place the Contract alignment in Zone 2, an area capable of producing earthquakes of greater than 7.0 on the Richter Scale. The New Madrid Fault Zone, the source of three of the most powerful earthquakes in recorded US history (in 1811 and 1812), is located about 250 miles southwest of the Contract site. No faults have been identified at the Contract site.

4.7 In-situ Stress

Available reports suggest that the site lies within a thrust fault regime zone of the Mid-Continent Region. Horizontal stresses are anticipated to be greater than vertical stresses, though studies disagree on the direction of the maximum principal stress. Testing to investigate the state of stress will be carried out by others in boreholes drilled from the surface during the work to measure the in- situ state of stress. Historical details are presented in the GDR. The Contract includes supplemental support provisions to address stress-induced deformations, should they occur.

5 RELEVANT PHYSICAL AND MAN-MADE CONDITIONS

5.1 Soil Deposits

As presented in the GDR, the borings encountered naturally deposited soil as well as soil placed as fill. Soil samples were collected through auger cuttings or by split spoon sampling. Only one boring, B-6, above the tunnel alignment was sampled using a split spoon sampler. The soils encountered in this boring were soft to stiff lean clay and silt with trace to some sand and fine gravel. These are assumed to be representative of soils within the Drumanard Estate. By visual examination of auger cuttings, native soil was encountered in all of the borings advanced. The soil appears to be orange-brown lean clay to silty clay (Unified Soil Classification System symbol CL) with thinner lenses of silt and possibly sand. The soils observed along the Contract alignment do not appear well drained; ponding of water at the surface following rains or snow melt-off was observed.

5.2 Soil – Rock Interface

Auger “refusal” – the point past which the hollow stem augers cannot physically be advanced - typically indicates the presence of the unweathered bedrock profile. Refusal occurred within a foot of when rock was first observed in a boring. If present at all, a weathered horizon of rock is estimated to be less than two feet thick.

The soil-rock interface is generally sub-parallel with the ground surface and occurs at depths between 3 and 16 feet in those holes located on or immediately adjacent to the Drumanard Estate (B-11, B-10, B-9, B-8, B-6, B-5, and B-7). However, at least four sinkholes were mapped on the surface along the Drumanard Estate, with several smaller sinks noted along the I-71 and US 42 road cuts and in the triangular shaped property at the intersection of KY 841 and US 42. The locations of some of these features are shown on Figure 1, as is the location of a spring and a sinking stream present on the Drumanard Estate.

The boreholes as drilled may have intersected the over-deepened profile of such surface karstic solution features, or represent a soil depth overlying a limestone unaffected by the solution process. Evidence of surface karstic solutioning, as exposed in near-by road cuts, ranges in depth from 10 feet to 25 feet. The rock interface with the natural soil was observed in cuts along US 42 and KY 841, and in the northern part of the unnamed stream that crosses the Drumanard Estate, and is estimated to be less than 5 feet, deeper where cover is thickest.

5.3 Louisville Limestone

The Louisville Limestone observed in the borings advanced for this Contract consists of a light gray, slightly weathered to fresh, medium strong to strong, fine-to medium-grained interbedded dolomitic limestone and dolomite with thin (<1/2 inch) interbeds of dark gray shaley limestone. Beds are randomly spaced from less than one foot to over five feet. Stylolites and macrofossils are rare. It exhibits only a thin, weathered rock zone, within 2 feet the rock becomes slightly weathered to fresh.

Voids, typically measuring less than 9 inches high were encountered in the Louisville Limestone in borings B-5, B-7, B-8 above the planned tunnel and B-13, and B-14, which are outside of the North Portal. The voids, when present, typically occur in the upper five to ten feet of the boring adjacent to the soil-rock interface. During the drilling, it was noted that in many of the borings, the drilling fluid

circulation was lost in the upper five to ten feet of the rock mass, indicating that such voids may be connected.

The characteristics and properties for the Louisville Limestone were evaluated through core log inspection, down hole tests, and laboratory tests. All of the laboratory test results are summarized on Table 5 of the GDR. Discontinuity spacings, RQD, Unconfined Compressive Strength, Brazilian Tensile Strength, Axial Point Load, Diametral Point Load, Cerchar Abrasivity, and Punch Penetration results are summarized in Table 1 and shown on Figure 4 in histogram format, with baseline averages indicated.

In borings located near the alignment, the formation thickness ranges from 26.8 feet to 39.4 feet. In the borings offset from the tunnel alignment (65 feet to 175 feet), the formation thickness ranges from 12 feet to 60 feet.

Properties	Table 1 - Louisville Limestone Range of Property Values		
	Minimum Value	Maximum Value	Baseline Average Value
Discontinuity Spacing (ft) From Borehole Televiwer	0.05	11.1	1
RQD	19	100	92
Unconfined Compressive Strength (psi) Sample No.	1,638 B-3	25,950 B-13-4	12,690
Split (Brazilian) Tensile Strength (psi) Sample No.	414 B-11-1	1,845 B-18-4	1,100
Axial Point Load (psi) Sample No.	332 B-17-6	1,445 B-6-9	860
Diametral Point Load (psi) Sample No.	130 B-7-10	1,871 B-6-9	850
Cerchar Abrasivity Index Sample No.	0.7 B-7-12	1 B-12-8	0.9
Punch Penetration (kip/in) Sample No.	93 B-18-4	134 B-12-9	121

5.4 Waldron Shale

The Waldron Shale observed in the borings and road cuts consists of medium to dark gray, very fine to fine-grained, fresh, weak to locally medium strong, thinly bedded shale with thin fine-grained dolomite interbeds. As described below, the shale demonstrates variable slake durability. Three competent

samples that could be prepared were subjected to petrographic analysis. The analyses of these more competent samples indicate that they are comprised of clay size and silt size particles of dolomite with 2 to 3 percent quartz. Limestone and dolomite beds up to 4 inches thick are locally present in the Waldron Shale, typically near the base of the formation. Limestone and dolomite materials will demonstrate a higher Mohs Hardness than the shale, as further described in the GDR. The limestone and dolomite beds can be expected to demonstrate strength properties characteristic of the underlying Laurel Dolomite. Both the upper contact of the Waldron Shale with the Louisville Limestone and the lower contact with the Laurel Dolomite are sharp and well defined features.

When freshly removed from ground, the shale core was recovered in "sticks" up to 2 feet in length. However, when allowed to air-dry for periods as short as one to three days, the shale core was observed to part along sub-horizontal planes into pieces ranging from 0.5 to 2 inches thick. This "poker-chip" behavior is reflective of strain relief of lateral in-situ stress.

The characteristics and properties for the Waldron Shale were obtained through core log inspection, down hole tests, and laboratory tests. In particular, samples of the shale were subjected to Slake Durability testing (Kentucky Method 64-513-02) to quantify the tendency of the shale to degrade with time. All of the laboratory test results are summarized on Table 5 of the GDR. Discontinuity spacings, RQD, Unconfined Compressive Strength, Brazilian Tensile Strength, Axial Point Load, Diametral Point Load, and Slake Durability results are summarized in Table 2 and shown on Figure 5 in histogram format, with baseline averages indicated. The total formation thickness was observed in all of the borings to range from 10.4 feet to 12.6 feet.

Properties	Table 2 - Waldron Shale Range of Property Values		
	Minimum Value	Maximum Value	Baseline Average Value
Discontinuity Spacing (ft) From Borehole Televiewer	0.1	4.9	1
RQD	90	100	96
Unconfined Compressive Strength (psi) Sample No.	1,924 B-2	9,390 B-12-3	5,900
Split (Brazilian) Tensile Strength (psi) Sample No.	425 B-10-8	758 B-15-5	500
Axial Point Load (psi) Sample No.	151 B-6-19	980 B-9-4	400
Diametral Point Load (psi) Sample No.	77 B-12-7	715 B-9-4	260
Slake Durability Index Sample No.	15.1 B-6-8	97.2 B-8-8	85

5.5 Laurel Dolomite

The Laurel Dolomite is described in the published literature as comprised of dolomite with a shale interbed in the lower third of the unit. As observed in the borings in the tunnel horizon, the Laurel Dolomite is comprised of the following three large-scale layers:

1. Layer #1: The upper and thickest part is a light gray to tan, fine- to medium-grained, medium strong to strong interbedded limestone, dolomitic limestone and dolomite. The rock mass is thin to thick bedded with few to no macrofossils or stylolites. A brown colored 5 to 10 foot thick zone of non-interconnected pits (<0.1 inch across) is present near the lower part of this sub-unit. The thickness of this sub-unit ranges from about 38 to 51 feet.
2. Layer #2: An interbed of dark gray, very fine grained, fresh, weak to medium strong, thinly bedded shale. This sub-unit is typically one to seven feet thick.
3. Layer #3: A basal part of dark gray, fine- to very fine-grained, fresh, medium strong to strong limestone and shaley limestone. This sub-unit is approximately four to nine feet thick.

Only the upper part of the Laurel Dolomite, that is, the interbedded limestone, dolomitic limestone and dolomite comprising Layer #1, will be encountered in the Exploratory Tunnel.

The characteristics and properties for the Laurel Dolomite were obtained through core log inspection, down hole tests, and laboratory tests. All of the laboratory test results are summarized on Table 5 of the GDR. Discontinuity spacings, RQD, Unconfined Compressive Strength, Brazilian Tensile Strength, Axial Point Load, Diametral Point Load, Cerchar Abrasivity, and Punch Penetration results are summarized in Table 3 and shown on Figure 6 in histogram format, with baseline averages indicated.

Properties	Table 3 -Laurel Dolomite Range of Property Values		
	Minimum Value	Maximum Value	Baseline Average Value
Discontinuity Spacing (ft) From Borehole Televiwer	0.1	8.5	1.2
RQD	57	100	97
Unconfined Compressive Strength (psi) Sample No.	8,190 B-14-6	24,410 B-14-10	15,650
Split (Brazilian) Tensile Strength (psi) Sample No.	651 B-2-2a	1,654 B-15-6	1,035
Axial Point Load (psi) Sample No.	224 B-5-4	1,792 B-9-10	990
Diametral Point Load (psi) Sample No.	31 B-11-9	1,567 B-10-10	930
Cerchar Abrasivity Index Sample No.	0.5 B-15-3	1.4 B-12-4	0.9
Punch Penetration (kip/in) Sample No.	96 B-15-3	165 B-15-5	135

5.6 Karstic Features

At least four sinkholes were mapped on the surface along the Drumanard property with several smaller sinks along the U.S. 42 road cuts, and in the triangular shaped property at the intersection of KY 841 and U.S. 42. The locations of some of these features are shown on Figure 1, as are the locations of a spring (or seep) and a sinking stream present on the Drumanard Estate. The largest of the sinkholes observed measures approximately 50 feet in diameter and on the order of 10 feet deep relative to the surrounding ground surface. Areas of small sinkholes with a cumulative length of up to 600 feet were also observed in local rock cuts.

For the purpose of this GBR, a karstic feature measuring from 6 inches to 2 feet maximum in size (length, width, height) is defined as a “solution channel”; a karstic feature measuring from 2 feet to 10 feet in advance length, width and height is defined as a “karstic void”.

Solution channels have been observed at the base of Louisville Limestone immediately above the limestone shale contact. Examples are shown in photographs of roadcuts along I-71 contained in Appendix B of the GDR. Solution channels can be identified at spacings estimated from 50 feet to several hundreds of feet apart. The examples illustrated had an estimated outflow of 5 to 10 gallons per minute while the majority of the exposure exhibited a dry or damp condition. It is considered that these flow channels could be examples, at a lower elevation, of the karst features which were encountered in the upper elevations of the Louisville Limestone (boreholes B-5, B-7, B-8, B-13, and B-14) associated with water loss from the boreholes and consistent with solution channels near the soil rock interface. Suggested measures for dealing with solution channels are discussed in Section 7 and illustrated in Contract Drawing S-005.

Where the rock cover is shallow, especially at the north end of the tunnel alignment, the Exploratory Tunnel design anticipates karst voids that will warrant grouting coupled with special support measures drilled above the tunnel roof prior to the advancement of the tunnel heading. Provisions have been included in the design of the Exploratory Tunnel to address these conditions, should they be encountered. These measures are discussed in Section 7 and illustrated in Contract Drawings S-009 and S-010.

5.7 Rock Mass Discontinuities

The rock mass can generally be described as having three main joint sets, with the near vertical joint set being highly variable. Joint orientations have been evaluated from the geotechnical logs, from borehole televiewer surveys, and from surface mapping. By considering the stereonet plots, televiewer surveys, and surface mapping on a regional basis, orientation estimates were developed for the tunnel alignment, as summarized in Table 4 below.

Stereonet plots of the vertical joints and sub-horizontal discontinuities (bedding planes) are presented in Figure 11 of the GDR.

Table 4 – Orientations of Main Joint Sets			
Set No.	Description	Dip (degrees)	Dip Direction (degrees)
1	Sub-horizontal	0 to 10	0 to 360
2	Sub-vertical	85 to 90	100 to 110 (280 to 290)
3	Sub-vertical	85 to 90	010 to 025 (190 to 205)
4	Sub-vertical	85 to 90	050 to 060 (230 to 240)
5	Sub-vertical	85 to 90	325 to 340 (145 to 160)

Other joints, which fall outside of the above joint set ranges, are categorized as random.

In general the joints observed in all formations encountered in the borings are tight to partly open with little to no infilling. Many of the joints in the road cuts, with the exception of the Louisville Limestone along I-71 at Milepost 12.0 and 12.3 and the Jeffersonville/Sellersburg Limestone at the U.S. 42 road cuts, appear to also be tight to partly open with little to no infilling or staining.

Many of the joints at the three aforementioned sites have been enlarged by solutioning. The majority of these joints are near the ground surface where surface water penetrated the ground and enlarged the joints.

Spacings between sub-horizontal bedding planes and joints have been evaluated from the logs of the recovered core, and from borehole televiwer surveys of boreholes. This information is shown on Figures 4, 5, and 6. For each of the rock units the wider spacings noted in the borehole logs reflect only those that caused breakage of the core, whereas the televiwer detected all bedding features. The televiwer data is considered to be the more indicative of defects that will influence rock breakage during excavation, and are therefore to be anticipated for baseline purposes.

5.8 Groundwater Conditions

The hydrogeology of the Contract area was investigated through a combination of surficial geologic mapping, surface-based geophysical investigations, borings, observation wells, downhole geophysics, and in situ packer permeability tests. Given the number of karst features and the poorly developed stream pattern observed across the site, the hydrogeology of the tunnel area is typical of an early stage of karst development. Although a significant amount of water may move vertically through some partly open vertical joints, the geomorphology, the results of downhole geophysical tests, and demonstrated hydraulic effects of voids during drilling, indicate that groundwater movement is controlled mainly by flow through discrete solution channels.

Borings were advanced to investigate the conditions at the following key geologic features:

- The soil-rock interface
- The contact between the Louisville Limestone and the Waldron Shale
- The limestone formations above the Waldron Shale
- The Waldron Shale formation
- The limestone formations below the Waldron Shale

Based upon observations made during drilling, and water levels recorded during dry and wet weather periods, groundwater levels vary greatly across the site. A number of wells suggest the presence of a perched water table approximately 6 to 15 feet below the ground surface, which equates to approximately 12 to 40 feet above the crown of the Exploratory Tunnel. It is considered that this could result from a perched condition at the soil/rock interface. However, other wells showed no evidence of a perched condition. Thus, the presence of a perched water table at the soil/rock interface cannot be definitely established.

Other observation wells were installed into the Laurel Dolomite. The observation well data, considered in total, suggest that there are two aquifers present across the site, one that is perched above the Waldron Shale, and one that exists within the lower Laurel Dolomite. The upper aquifer is likely to have a water table ranging from approximately 10 to 50 feet above the crown of the Exploratory Tunnel. The lower aquifer is expected to lie in the range of elevation 427 feet to 509 feet, or approximately 50 feet below to 20 feet above the invert of the Exploratory Tunnel.

Packer tests were conducted in selected borings to assess the rock mass permeability. The tests were assessed using the method described by Houlsby to produce a likely permeability value over the test zone. The majority of the tests indicate a permeability ranging from 2.3×10^{-8} cm/s to 7.4×10^{-6} cm/s. However, a test conducted in Boring B-6 approximately six feet below the invert of the Exploratory Tunnel indicates a substantially higher permeability value of 1.2×10^{-3} cm/s. It is concluded that the former tests reflect the mass permeability of the intact rock units, whereas the latter test encountered a vertical feature as documented in the core logs.

It is believed that because a majority of the boreholes were drilled vertically, few vertical discontinuities were physically intersected in the boreholes. Perhaps more importantly, none of the borings encountered solution channels thought to exist in the Louisville Limestone at or just above the contact with the underlying Waldron Shale. It is these undetected features that can be expected to generate the majority of the groundwater inflow during tunnel excavation. Because of the likely connection to the ground surface, inflows along such solution features can be expected to increase during wet weather periods.

Expected groundwater inflows during tunnel excavation are addressed in Section 7.

It is anticipated most of the flow will come from discrete locations and will decrease from an initial higher rate to a steady state, and will eventually reduce to zero if the source is a natural cistern. If the source of inflow is an active solution channel or a vertical joint, the inflow can be expected to increase in response to rainfall precipitation events.

Inflow during a significant precipitation event is more likely to be a concern. It is uncertain how much recharge area an active solution channel might drain. Consequently, solution channels encountered during tunneling will be either channeled to maintain flow across the tunnel as detailed on Contract Drawing S-005, or monitored during precipitation events to determine whether special measures will be required to address the inflow.

5.9 Gas

In the Louisville area naturally occurring gas (primarily methane) has rarely been encountered, and where present, it is found at random and variable intervals in the bedrock. Regionally, natural gas has rarely been encountered in the soil.

Gas was encountered in two readings taken in Boring B-11 at a depth of 35 feet and Boring B-12 at a depth of 25 feet. The Lower Explosive Limit (LEL) readings recorded were for 2 and 3 parts per million (ppm) respectively. Both of these readings were recorded while drilling in the Jeffersonville/Sellersburg Limestone. The field staff noted no odor or sign of gas venting from the borehole at the time these readings were taken.

The gas level indicators also indicated levels of Carbon Monoxide (CO) up to 6 ppm in Borings B-11 and B-12. However, some of the readings registered were negative numbers and cast doubt as to the validity of the positive CO readings.

Gas was encountered in borings advanced along the Ohio River for the Riverbank Filtration Tunnel which is located about 8,000 feet north of the Exploratory Tunnel portal as described in the GDR. These borings were drilled in deeper and older formations than those encountered along the tunnel alignment. The source of the gas is not known nor is the geologic mechanism for the gas entrapment.

Based on these results, the Exploratory Tunnel Supplemental Specifications have been developed on the basis that the tunnel is classified as Potentially Gassy, in accordance with OSHA regulations.

5.10 Surface Structures and Utilities

With the exception of the intersection of KY 841 and U.S. 42, the land surrounding the Exploratory Tunnel and access ramp alignments is either developed for residential use or is listed on the National Register of Historic Places (NRHP). Contract Drawing G-008 defines the approximate property lines and respective property owners.

The Drumanard Estate Gardens and Buildings are registered on the National Register of Historical Places. The Register inventory lists 55 acres, 6 buildings, 3 structures, and two objects consisting of the following:

- Gardens, trees, and plantings designed by nationally renowned landscape architects that cannot be disturbed or damaged by construction-related blast vibrations or lowering of the groundwater table
- The Drumanard buildings, which are located some 440 feet west of the Exploratory Tunnel alignment
- Other historic structures on the Estate that are located from 140 feet to 400 feet from the alignment

Another historic structure is the Allison Barrickman House, which is located immediately south of KY 841 and the Exploratory Tunnel portal access ramp area. The property falls within a 500-foot offset from the Contract site.

Two residential communities located near the site include the Bridgepointe subdivision located northeast of the Exploratory Tunnel alignment and the Shadow Wood subdivision located northwest of the northern terminus of the Exploratory Tunnel.

Utilities, power line poles and buried fiber optics are present in an easement running parallel to the north side of U.S. Route 42 between the highway and the Drumanard Estate property line. The approximate locations of these utilities as well as near-surface culverts are shown on the Contract Drawing IM-002.

5.11 Previous Construction Experience

Previous experience with rock excavation in the Contract vicinity is limited to the road cuts exposed within the Jeffersonville Limestone on US 42 and KY 841. New rock cuts have been exposed (in late 2006, early 2007) in order to relocate the KY 841 off ramp and widen US 42. These new exposures have not been subject to inspection or assessment in this report or the GDR.

5.12 Interpretation of Baseline Values

With regard to variations in material properties and characteristics, and rock mass parameters, a claim for additional compensation will only be considered with regard to such material properties and characteristics, and rock mass parameters, for the entire tunnel alignment. No claim will be considered to have merit or reasonable basis if predicated solely on a portion of the tunnel alignment.

6 ANTICIPATED GROUND CONDITIONS

6.1 Lithologies by Tunnel Reach

The Exploratory Tunnel has been divided into four reaches that reflect changes in the rock formation(s) expected to be encountered during tunnel excavation. This assessment is based upon an interpolation of contours at the top and base of the Waldron Shale as encountered in certain boreholes, as indicated on Figures 2 and 3.

6.2 Rock Mass Conditions and Classification

To determine the quality and condition of the rock, and to classify the expected ground conditions, two Rock Mass Classification systems were used: the Q-system as originally proposed by Barton, Lien & Lunde (1974), with a further update by Grimstad and Barton (1993); and the Rock Mass Rating classification system (RMR), as developed by Bieniawski (1989). A key parameter common to both classifications is the Rock Quality Designation (RQD) (Deere, D.U. and Deere, D. W., 1984). Data and baseline values of RQD are summarized in Figures 4, 5, and 6 for the three rock units, respectively. It is noted that RQD was assessed as the core was recovered immediate from the boreholes. The tendency of the Waldron Shales to form “poker chips” thereafter is not reflected in the RQD values shown on Figure 5. This effect can be expected to reduce the RQD values from the high 90s logged to below 25. The lower values were included in the rock mass classification assessments described below.

6.2.1 Rock Mass Classification, Q-Value

The key parameters for assessing Q-Value include: RQD, Joint set number (Jn), Joint roughness number (Jr), Joint alteration number (Ja), Joint water reduction factor (Jw), and Stress Reduction Factor (SRF). Reviewing the rock core, core photographs and boring logs parameter values were selected, and then choosing the appropriate value of the various parameters as described in Barton (1974, 1993). Q was then computed by Equation 1 below. The term ‘RQD/Jn’ in Equation 1 is intended to reflect rock block size. The term ‘Jr/Ja’ is an indicator of the inter-block shear strength, and Jw/SRF is a representation of the active in-situ stress:

$$\text{Equation 1: } Q = (\text{RQD}/\text{Jn}) \times (\text{Jr}/\text{Ja}) \times (\text{Jw}/\text{SRF})$$

The rock classification systems based on different Q values are summarized in Table 5. The estimated Q values for the three rock types within the tunnel horizon are summarized on Table 6. The Q values range from a low of 0.07 (Extremely Poor) in the Waldron Shale to a maximum of 17 (Good) in the Louisville Limestone.

Numeric mean Q values were estimated to be 6.1 (Fair) for the Louisville Limestone, 0.4 (Very Poor) for the Waldron Shale, and 6.6 (Fair) for the Laurel Dolomite. It is noted that much interpretation is required to estimate the input parameters when determining Q values. The value range extends from 0.001 to 1000, and is logarithmic in nature. Thus, each classification category reflects a broad range in Q value.

Furthermore, the original classification was developed for deeper, more confined excavations than the planned excavation, which lies close to the rock surface in an environment that could be adversely influenced by karst-related groundwater inflows and levels of near-surface in situ stress. Because of the subjective and variable nature of the estimated Q values, it is the general ground classification that is

considered indicative of the anticipated conditions, not the precise Q values. The Q values were utilized to develop the tunnel initial support systems shown on the Contract Drawings.

Q	Classification
400 – 1,000	Exceptionally Good
100-400	Extremely Good
40-100	Very Good
10-40	Good
4.0-10.0	Fair
1.0-4.0	Poor
0.1-1.0	Very Poor
0.01-0.1	Extremely Poor
0.001-0.01	Exceptionally Poor

Formation Type	Range of Q Value		
	Lower Value	Upper Value	Mean Value
Louisville Limestone	3	17	6.1
Waldron Shale	0.07	1	0.4
Laurel Dolomite	4	8	6.6

6.2.2 Rock Mass Rating, RMR

The parameters used to evaluate RMR are Intact Strength - (by Point Load Strength Index and Unconfined Compressive Strength, UCS), RQD, spacing of discontinuities, condition of discontinuities and their orientation to planned direction of drive, and groundwater conditions.

Similar to Q, RMR values were evaluated for each rock unit. For each assessed rock unit, the parameters shown in the Rock Mass Rating System were evaluated and their individual ratings summed to determine the overall RMR values. The RMR classification system and estimated RMR values are summarized in Tables 7 and 8.

Both Q and RMR will be evaluated in the field to determine the actual support system requirements to be installed.

Table 7 – RMR Rock Mass Rating Classification System (after Bieniawski, 1989)	
RMR	Classification
100 – 81	Very good rock
80 – 61	Good rock
60 – 41	Fair rock
40 – 21	Poor rock
20 – 0	Very poor rock

Table 8 – Rock Mass Rating (RMR) Values for Project Site Formation Types			
Formation Type	Range of RMR Value		
	Minimum	Maximum	Mean
Louisville Limestone	36	70	63
Waldron Shale	36	64	55
Laurel Dolomite	34	71	63

7 DESIGN AND CONSTRUCTION CONSIDERATIONS

7.1 Method of Tunnel Excavation

This GBR has been prepared with the anticipation that the tunnel will be excavated using drill and blast methods. Alternative methods including roadheaders or impact hammers coupled with line drilling of the profile will also be considered, subject to approval by the Engineer.

7.2 Tunnel Alignment

As indicated on the Contract Drawings, the Exploratory Tunnel has been selected to trend along the alignment of the future southbound highway tunnel, and is located within the upper portion of the highway tunnel cross-section.

7.3 Tunnel Support Design

Utilizing the rock mass quality assessments of Q and RMR discussed in Section 6, tunnel support types were developed to address the range of ground conditions anticipated in the Exploratory Tunnel. Tunnel support measures generally consist of pattern rock bolts and welded wire fabric installed in the roof and sidewalls. These measures may be augmented with shotcrete and invert concrete protection where the tunnel encounters poorer rock mass conditions. The rock bolts are to consist of fiberglass bars to facilitate future highway excavation. Requirements for rock support elements are contained in the Exploratory Tunnel Supplemental Specifications.

Typical tunnel support types are Type I, II, and III, as shown on Contract Drawing S-003. These support types will be determined based on the actual ground classifications. Type IV, which is a mandatory support type, was developed to provide unclassified support where the tunnel crosses beneath Highway 42. This support type is to be installed independent of the assessed rock mass classification. A fifth type, Type EBC, was developed to support the wider span exploration bays as shown on Contract Drawing S-004. Type EBC support includes pattern rock bolts and welded wire fabric on the arch and walls, as well as shotcrete as directed by the Engineer. Type EBC support shall be augmented with additional shotcrete and invert concrete protection where the tunnel encounters poorer rock mass conditions.

The initial 30 feet of tunnel from the portal will require a mandatory support pattern, Type P, as shown on Contract Drawings S-001 and S-002 and specified in Exploratory Tunnel Supplemental Specification 31 72 13.

To address localized conditions as well as karst features, the Exploratory Tunnel Supplemental Specifications include provisions for the installation and payment of supplemental rock bolts, welded wire fabric, shotcrete, steel ribs, canopy tubes and self-drilling rock bolts, all as directed by the Engineer in the field.

Figures 2 and 3 show the baseline usage of the various support types along the four tunnel reaches. The Exploratory Tunnel Supplemental Specifications designate the means by which ground support requirements will be assessed by the Contractor and agreed between both the Contractor and Engineer as excavation proceeds. With regard to variations within specific reaches, or elements of work based upon such variations, a claim for additional compensation will only be considered with regard to total support quantities as given in Figures 2 and 3 for the entire tunnel alignment. No claim will be considered to have merit or reasonable basis if predicated solely on a portion of the tunnel alignment.

Rock mass behavior during tunneling will be influenced by the characteristics of the rock mass, including joint and other discontinuity spacings, their orientations with respect to the tunnel axis, spacings relative to the tunnel and exploration bay spans, and amount of groundwater inflow. The degree of difficulty that the Contractor will face in excavating the tunnel and the exploratory bays will also depend upon the method and type of construction e.g. drill and blast, blast vibration restrictions, the round length excavated, control of perimeter look-out angles, the timely installation of support when required to stabilize deteriorating rock materials, and the muck handling and pumping systems employed particularly in those sections where shale will be exposed in the tunnel.

Blocks formed by bedding planes and other sub-horizontal discontinuity surfaces will be prone to fallout when they are cut by near-vertical adversely oriented discontinuities. Joint surfaces can be expected to be open, or will contain clay, rock fragments, or gouge material resulting from solution effects of ground water flow in the limestone. As discussed in the GDR, zones of closely spaced vertical joints have been observed in nearby road cuts at fifty to several hundred feet intervals.

Due to the closely jointed nature of the rock mass, and the well-defined bedding planes that have been observed, block fallout can be expected to occur in all excavations. Block fallouts are expected to include the following:

- Slab fallout that occurs during blasting or scaling caused by the tendency for rock to break back to sub-horizontal discontinuities.
- Progressive failure by gradual loosening and fallout of small blocks of rock. This failure mode is likely to occur in shales if initial support is not installed immediately after the tunnel is excavated.
- Block failure in the sidewalls due to undermining by a softened shale invert condition.

A certain degree of overbreak should be anticipated, notwithstanding the application of good workmanship and the use of proper controlled blasting and other excavation procedures. Contract Drawing numbers C-007 and C-008 designate the excavation lines for the Exploratory Tunnel and exploration bay enlargements including:

- Excavation
- An allowance for initial support
- The minimum dimension which all ground support elements shall lie outside

The risks and costs associated with overbreak volumes from the designated excavation line as shown on drawings C-007 and C-008 are the responsibility of the Contractor.

7.4 Tunneling Conditions by Reach

Four reaches, R1 through R4, were developed to reflect the rock type(s) anticipated to be encountered along the tunnel alignment. These Reaches are illustrated on Figures 2 and 3 which show the estimated percentages of the different initial support types to be installed within each reach, in the tunnel entrance portal, in the section of tunnel beneath Highway 42, and in the four exploration bays. Details of these support measures, as well as the tunnel support measures at the portal, are shown on the Contract Drawings.

Reach 1

Reach 1 is estimated to extend from SB 50+00 to SB 52+50. It is expected that Reach 1 will encounter the Louisville Limestone in the invert, walls and roof. The beginning 30' of Reach 1 is the portal design for the exploratory tunnel. Towards the end of the reach, shale can be expected to be encountered in the invert. The rock mass is intersected by a sub-horizontal joint system with variable spacing averaging about 1 foot. The vertical joints based on mapping of existing rock exposures are randomly spaced at 2 to 10 feet and typically within 10 degrees of vertical. Groundwater inflow is to be expected. Rock mass permeability in this reach are on the order of 1.0×10^{-7} cm/s, however the permeability of vertical joints is expected to be on the order of 1.0×10^{-3} cm/s.

Reach 2

Reach 2 is estimated to extend from SB 52+50 to SB 57+50. At the beginning of Reach 2, the Louisville Limestone is anticipated to be encountered in the Exploratory Tunnel roof and walls, with Waldron Shale encountered in the invert. As the reach progresses northward, the Waldron Shale is anticipated to rise relative to the downward-sloped tunnel drive, such that at the end of the reach, Louisville Limestone is anticipated to be encountered only in the crown and the upper 50% of the walls, with Waldron Shale anticipated to be encountered in the invert and lower 50% of the walls. The shale in this reach is typically weaker than the overlying Louisville Limestone. The presence of two dissimilar rock formations in the heading at the same time will need to be addressed in the Contractor's excavation procedures to avoid over excavation of the weaker shale. The rock mass is intersected by the same sub-horizontal and vertical joint system as in Reach 1. Groundwater inflow is to be expected. Rock mass permeability measurements range from 1.0×10^{-7} cm/s to 1.6×10^{-5} cm/s, however the permeability of vertical joints is expected to be on the order of 1.0×10^{-3} cm/s.

Reach 3

Reach 3 is estimated to extend from SB 57+50 to SB 61+00. At the beginning of Reach 3, Louisville Limestone is anticipated to be encountered for the top 50% of the wall and crown, with Waldron Shale comprising the invert and lower 50% of the walls. At the end of the reach, Louisville Limestone is anticipated to be in the crown only, with Waldron Shale in 100% of the tunnel walls and invert. The shale in this reach is shown as being of variable slake durability (results from B-10 samples vs. B-11 samples). As in Reach 2, the shale will be weaker than the overlying Louisville Limestone. Because the shales will eventually occupy the full wall height, the potential for overbreak is greater than in Reach 2. Again, the presence of two dissimilar rock formations in the heading at the same time will need to be addressed in the Contractor's excavation procedures to avoid over excavation of the weaker shale. The Louisville Limestone will be intersected by the same sub-horizontal and vertical joint system as in Reaches 1 and 2, however closer and weaker bedding planes are expected in the shale. Also, thin (on the order of 4 inches thick) layers of limestone and dolomite observed to occur in the lower portion of the shale can be expected to make the excavation of the shale more difficult. Groundwater inflow is to be expected. Rock mass permeability measurements in this reach range from 1.0×10^{-7} cm/s to 1.3×10^{-4} cm/s, however the permeability of vertical joints is expected to be on the order of 1.0×10^{-3} cm/s.

Reach 4

Reach 4 is estimated to extend from SB 61+00 to SB 68+00, the terminus of the Exploratory Tunnel. At the beginning of Reach 4, it is anticipated that Waldron Shale will be encountered in the roof and the majority of the walls, with Laurel Dolomite in the invert and only a small portion of the walls. As the tunnel moves towards the north, Waldron Shale is anticipated in the roof and approximately the upper

50% of the walls, with Laurel Dolomite anticipated in the invert and approximately the lower 50% of the walls. Because the true top elevation for the Waldron Shale is unconfirmed along this reach, it should be expected that the upper limestone will also be encountered in the roof for limited distances and will be intersected by the same sub-horizontal and vertical joint system as in Reaches 1, 2 and 3. Because of the substantial presence of the Waldron Shale, this reach is anticipated to require 100% Type III support. Groundwater inflow is to be expected. Permeability values measured in the shale for this reach range from 2.8×10^{-6} cm/s to 1.1×10^{-4} cm/s, however artesian conditions are anticipated where vertical joints in the underlying Laurel Dolomite are encountered.

Invert

Due to the tendency of the Waldron Shale to degrade, wherever the shale is encountered, invert concrete is to be placed as required by Exploratory Tunnel Supplemental Specifications, Section 31 71 16.01 and Section 31 71 23. This requirement will pertain to both the tunnel and the Exploration Bays. The payment provisions anticipate invert concrete for approximately 800 feet of the tunnel, between approximately Stations SB 52+50 and SB 60+50.

Karstic Features

When solution channels are encountered, they will be addressed in the following ways:

1. Probe drilling (discussed below) to detect their existence in advance of encountering them in the heading. If encountered by probe drilling, formation grouting in advance of the heading could take place.
2. If interrupted by the tunnel cross-section, a solution channel exposed on one sidewall of the excavation can be re-connected to the continuing solution channel on the opposite sidewall as shown on Contract Drawing S-005 and Exploratory Tunnel Supplemental Specifications Section 31 71 29 - Control and Removal of Tunnel Water.
3. Where re-connection of solution channels is not feasible, such inflow will be addressed by secondary grouting behind the tunnel face if sustained inflow exceeds flow levels as defined in Exploratory Tunnel Supplemental Specifications Section 31 71 26 - Probe Drilling and Grouting and Contract Drawings S-007 and S-008.

Solution channels can be expected to be encountered anywhere along the Exploratory Tunnel alignment. As a baseline, expect that 20 such channels will be encountered and that 50% will exhibit flow when encountered. Individual solution channels can be expected to be spaced as closely as 10 feet and as widely as hundreds of feet. Observations suggest that these solution channels will occur more frequently at the base of the limestone above the Waldron shale interface, and at the top of the Dolomite just below the shale contact.

The potential for encountering karstic voids is the greatest in the Louisville Limestone, particularly in the roof in areas of low ground cover, and near the contact with the underlying Waldron Shale. Where karstic voids are encountered, the Contractor can expect increased difficulties associated with:

- Soil infilling of the encountered voids
- Flush flows associated with stored groundwater in the voids and any connecting joints and solution channels

- Support of openings that extend beyond the normal excavation profile
- Support of the rock mass adjacent to such voids

Ground support design for karstic voids will be dependent on actual site conditions encountered. Contract Drawings S-009 and S-010 show suggested procedures and methods requiring installation of 40-foot canopy tubes for dealing with a single feature. For baseline purposes, bid items have been included in the Exploratory Tunnel Supplemental Specifications and Schedule of Bid Items to account for two (2) karstic voids measuring from 2 feet to 10 feet in advance length, width and height.

Groundwater Inflows

Groundwater inflows are anticipated to occur in all reaches during the work and groundwater control measures will need to be instituted along the alignment. Groundwater inflows during tunnel excavation will be measured in terms of heading inflows and long-term inflows. The Exploratory Tunnel Supplemental Specifications contain the requirement details by which groundwater inflow measurements will be made.

The heading is defined as a zone extending 20 feet back from the face of excavation. Heading inflows are groundwater inflows (exclusive of the Contractor's construction water) measured and captured 20 feet back from the face of excavation, and conveyed to the portal. Heading inflows can be expected to occur anywhere along the tunnel, will be manifested initially as a peak flow rate from a specific feature or feature(s), and will decay over time as the storage of groundwater associated with that feature or features is depleted. For baseline purposes, the Contractor should expect to encounter 10 heading inflow events up to a peak inflow rate of 100 gallons per minute (gpm), during the work. The rate of decay can be expected to vary. For baseline purposes, assume that the time for peak inflows to decay to 1/20th of the peak flow rate will range from 24 to 72 hours, and average 48 hours.

In an effort to reduce the impacts of heading inflows in the downgrade Exploratory Tunnel drive, the Contractor should have an available pumping capacity capable of handling 100 gallons/minute within a maximum distance of 20 feet behind the tunnel face in addition to that required for his construction needs and that required for fire fighting capacity. All water pumped from the tunnel is required to be treated prior to discharge, in accordance with Exploratory Tunnel Supplemental Specifications Section 31 71 29.

Long term inflows are defined as the flow rate of ground water removed at the tunnel portal (exclusive of the Contractor's construction water) that derives from inflows and seepage occurring from the tunnel perimeter behind the heading. For baseline purposes, the Contractor is responsible for capturing, piping, pumping, treating, and disposing of up to 15 gpm of long term inflows at all times during the work. Long term inflows are in addition to any heading inflows that may occur. Long-term inflows will enter the tunnel through a variety of means, including discontinuities such as joints, bedding planes, and solution channels.

7.5 Tunnel Mapping

The Engineer will also carry out tunnel mapping and inspection during excavation using both the Q and RMR rock mass classification systems to evaluate tunneling and groundwater conditions and to confirm the Contractor's recommendation or assess the need for additional tunnel support. The Contractor will be required to provide access in the heading on a regular basis, and to allow for uninterrupted access for tunnel mapping.

7.6 Probe Drilling

Probe drilling is required to be carried out continually along the entire tunnel alignment. The purpose for probe drilling is to assess the nature of the ground, particularly the presence of karstic features above the tunnel roof, and to identify the potential for groundwater inflows ahead of the face. Exploratory Tunnel Supplemental Specifications Section 31 71 26 and Contract Drawing S-007 contain the requirements for probe drilling along the tunnel alignment. All probe holes are to be tested for methane and explosive gases in accordance with Exploratory Tunnel Supplemental Specifications Section 01 35 00.

7.7 Formation Grouting

Grouting is required to control groundwater inflows and to control tunnel stability in locations of low ground cover. Grouting will be instituted in order to reduce the potential for the depletion of perched groundwater that serves vegetation on the Drumanard Estate. Control of grouting pressures and volumes will be critical to effective grouting where overburden is low. Criteria, procedures, and requirements for probe drilling and grouting are presented in Exploratory Tunnel Supplemental Specifications Section 31 71 26.

The baseline estimate for grouting ahead of the face per Contract Drawing S-008 is defined as follows:

- Single Cover Grouting: 10-percent of tunnel length
- Double Cover Grouting: 5-percent of tunnel length
- Primary and secondary pattern of grout holes will be required.

Post excavation grouting shall be carried out as directed by the Engineer at locations within the tunnel where groundwater continues to form a permanent inflow into the completed tunnel. For baseline purposes, assume a total of 40' length of tunnel will require post excavation grouting.

The need for both pre and post excavation tunnel grouting can be expected in any location along the tunnel.

7.8 Gas and Ventilation

The Contractor is to assume that the tunnel will be classified as "Potentially Gassy" in accordance with 29 CFR OSHA 1926-800. Monitoring for gas is required in accordance with prevailing Federal and State regulations and Exploratory Tunnel Supplemental Specifications Section 01 35 00.

7.9 Highway 42

The Exploratory Tunnel Supplemental Specifications require that Highway 42 remain in operation during tunnel construction but that traffic is stopped temporarily during periods of blasting beneath and in proximity to the highway. Monitoring of vibration and surface settlement must be carried out in accordance with specification requirements.

8 INSTRUMENTATION AND EXPLORATION REQUIREMENTS

8.1 Introduction

The Contract Drawings and Exploratory Tunnel Supplemental Specifications contain the requirements for ground performance instrumentation, settlement monitoring, vibration monitoring, and planned geotechnical investigations. The Contractor is responsible for completing the procurement, installation and maintenance of all instruments and readout units or data-loggers.

8.2 Piezometers

Standpipe piezometers have been installed in existing boreholes as shown on Contract Drawings IM-002 and IM-003. Automatic readout devices are required to be installed and maintained by the Contractor in selected standpipe wells.

8.3 Stream flow Measurements

Automatic flowmeters will be installed by the Contractor to monitor stream flows across the Drumanard Estate as shown on Contract Drawings IM-002. Outflow of water from the tunnel will be monitored at the tunnel portal. The Contractor is required to install and maintain the instrumentation.

8.4 Rainfall Measurements

The Contractor is required to establish and maintain an automatic rain gauge adjacent to the Contractor's working area. This will provide correlation to stream flow and potential run-off quantities.

8.5 Blast Vibration Monitoring and Pre-Construction and Post Construction Condition Surveys

All blasting and vibration monitoring and condition survey activities shall be in conformance with requirements set forth in Special Notes for Blasting and Vibration.

8.6 Ground Settlement

Review and alert levels have been specified in Exploratory Tunnel Supplemental Specification 31 09 13 for settlement markers and surface monitoring points shown on IM-002 for US Highway 42.

8.7 Excavation Deformations

Convergence monitoring and monitoring of ground displacement with rod and wire extensometers are required at selected locations within the tunnel and Exploration Bays during excavation. Convergence monitoring locations and anchor points are to be located in accordance with Contract Drawings GI-003 through GI-008.

8.8 Cyclical Wetting and Drying Chambers of Waldron Shale

Cyclical Wetting and Drying Chamber consisting of a perforated water sprayer or pipe mounted to a rigid frame shall be installed as described in Exploratory Tunnel Supplemental Specification 02 32 13 and shown on contract Drawings GI-010 through GI-012. Cyclical wetting and drying tests on the Waldron Shale shall consist of spraying water through the perforated sprayer for the period specified followed by a specified drying period to allow the rock surface to dry or to a cycle duration as instructed by the Engineer.

8.9 Geophysical Investigations

Resistivity and refraction tomography surveys are to be carried out by the Engineer along traverse lines as shown on Contract Drawing GP-001. Two parallel resistivity survey lines are to be conducted in the invert of the Exploratory Tunnel as detailed on Contract Drawing GP-001. The Contractor is to provide access so that the survey is complete and preliminary analysis is developed prior to the commencement of exploratory drilling within the adjacent Exploration Bay.

8.10 Exploratory Investigation Drilling

Exploratory borings with core recovery will be drilled within each Exploration Bay as detailed in Contract Drawing GI-002. Geophysical logging of these holes are required. Piezometers are to be installed as detailed on Contract Drawings.

Exploration probe holes with no recovery are also required, as detailed in Contract Drawing GI-001. Crosshole tomography holes will be required as per Exploratory Tunnel Supplemental Specification 02 32 13 and illustrated on Contract Drawing GI-001.

8.11 Record of Exposed Tunnel Geology

The Contractor will be required to carry out geologic mapping and digital tunnel photography in accordance with Exploratory Tunnel Supplemental Specification 02 32 13. Such work will need to be scheduled concurrent with ongoing tunnel excavation work.

9 LIMITATIONS

The interpretations and assessments contained in this report are based upon the available information from limited surface mapping, borings, in situ tests and laboratory tests. The geologic environment of the overburden at the site and of the bedrock along the tunnel alignment is complex, and as such, no amount of pre-construction information will convey as detailed an understanding as will exist following excavation. The range of expected site and construction conditions presented in this report is established as a baseline to be used by all bidders in preparing their bids. The expected conditions were developed with the standard of care commonly applied as the state of the practice in the profession. No warranty is included; either expressed or implied that the actual conditions encountered will conform to the baseline conditions described herein.

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GEOTECHNICAL BASELINE REPORT

APPENDIX A

Appendix A:

In Geologic Map of the Louisville 30 x 60 minute Quadrangle (Thomas Sparks and Qinhu Zhang Geologic Map 4 Series Xii, 2003, UKY KGS) provide a summary description of the mapped geologic members and units encountered Contract area and recovered in cores from the site investigation program. It is reproduced below for reference and comparison purposes.

Devonian

SELLERSBURG AND JEFFERSONVILLE LIMESTONES-

Unit composed of Sellersburg and Jeffersonville Limestones, as well as some New Albany Shale in Owen 7.5-minute quadrangle. Sellersburg Limestone includes Beechwood and Silver Creek Limestone Members. Beechwood Limestone, coarse to very coarse fossil fragments and whole fossils in matrix of silt-size lime mud or very finely crystalline calcite; locally cherty; very thin- to thin-bedded. Silver Creek Limestone, dolomitic, argillaceous; cryptogamed to micrograined; bedding laminated to crosslaminated. Jeffersonville Limestone, fossil fragments in matrix of spary calcite or calcareous mudstone; pyritic; locally dolomitic; scattered banded chert in thin irregular stringers. Abundant whole fossils include large colonial corals in lower part and brachiopods in upper part. Unit is unconformable with underlying Louisville Limestone.

JEFFERSONVILLE LIMESTONE-

Limestone, fine to very coarse fossil fragments and whole fossils in matrix of silt- to clay-size lime mud or crystalline calcite, Unit is mapped separately in La Grange and Crestwood 7.5-minute quadrangles.

Silurian

LOUISVILLE LIMESTONE-

Dolomitic limestone, dolomite, and minor shale. Dolomitic limestone, micrograined to fine-grained; very thin- to thick-bedded; styfolitic; abundant large fossil fragments and whole fossils. Dolomite, calcitic, very fine- to fine-grained with abundant, very coarse-grained fossil fragments. Fossils include brachiopods, stromatolites, and corals. Unit mapped in west part of the quadrangle; dolomitization increases from north to south.

WALDRON SHALE--Shale, clayey, dolomitic; bedding obscure, sparse fossils; poorly exposed.

LAUREL DOLOMITE—

Dolomite and minor shale. Dolomite composed of two types: (1) micrograined to very finely crystalline; characterized by even beds commonly 0.1 to 1 m thick; contains calcite in irregular patches; locally contains thin discontinuous chert layers and nodules; fossils, including crinoid columnals and rare brachiopods; forms upper part of unit; and (2) massive, porous, mottled, thick- to very thickbedded, bedding obscure; contains clasts of colorless calcite; forms lower part of unit. Shale, dolomitic, laminated, fossils rare or absent, occurs in middle or lower part of unit.

OSGOOD AND BRASSFIELD FORMATIONS-

Unit composed of Osgood and Brassfield Formations. Osgood Formation, shale, dolomite, and dolomitic mudstone. Shale, dolomitic; laminated, poorly fissile; in part distinct 3- to 8-cm-thick even beds, indistinct where weathered. Dolomite, generally very fine-grained, thin- to thickbedded with thin shale or dolomitic mudstone partings; rare fossils. Dolomitic mudstone, thin-bedded; locally present. Osgood Formation is conformable but may ~ be locally unconformable with the underlying Brassfield Formation. Brassfield Formation, limestone and dolomite. Limestone, fine- to coarse-grained; locally crossbedded; contains whole and broken fossils and scattered thin lenses of porcelaneous chert. Dolomite, calcitic and similar to the limestone, occurring as both medium- to coarse-grained and very fine-grained types. Limestone and dolomite interbedded and intergraded. Basal contact unconformable.

BRASSFIELD FORMATION-

Limestone and dolomite. Limestone, fine- to mediumgrained, well-sorted; consists mostly of erinoid and bryozoan fragments cemented by spary calcite; slightly phosphatic and glauconitic. Dolomite, finely crystalline; contains abundant vugs. Unit grades from limestone at base to dolomite at top.

Ordivician

DRAKES FORMATION-

Unit consists of three members: in ascending order, they are the

- *Rowland,*
- *Bardstown, and*
- *Saluda Dolomite Members.*

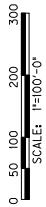
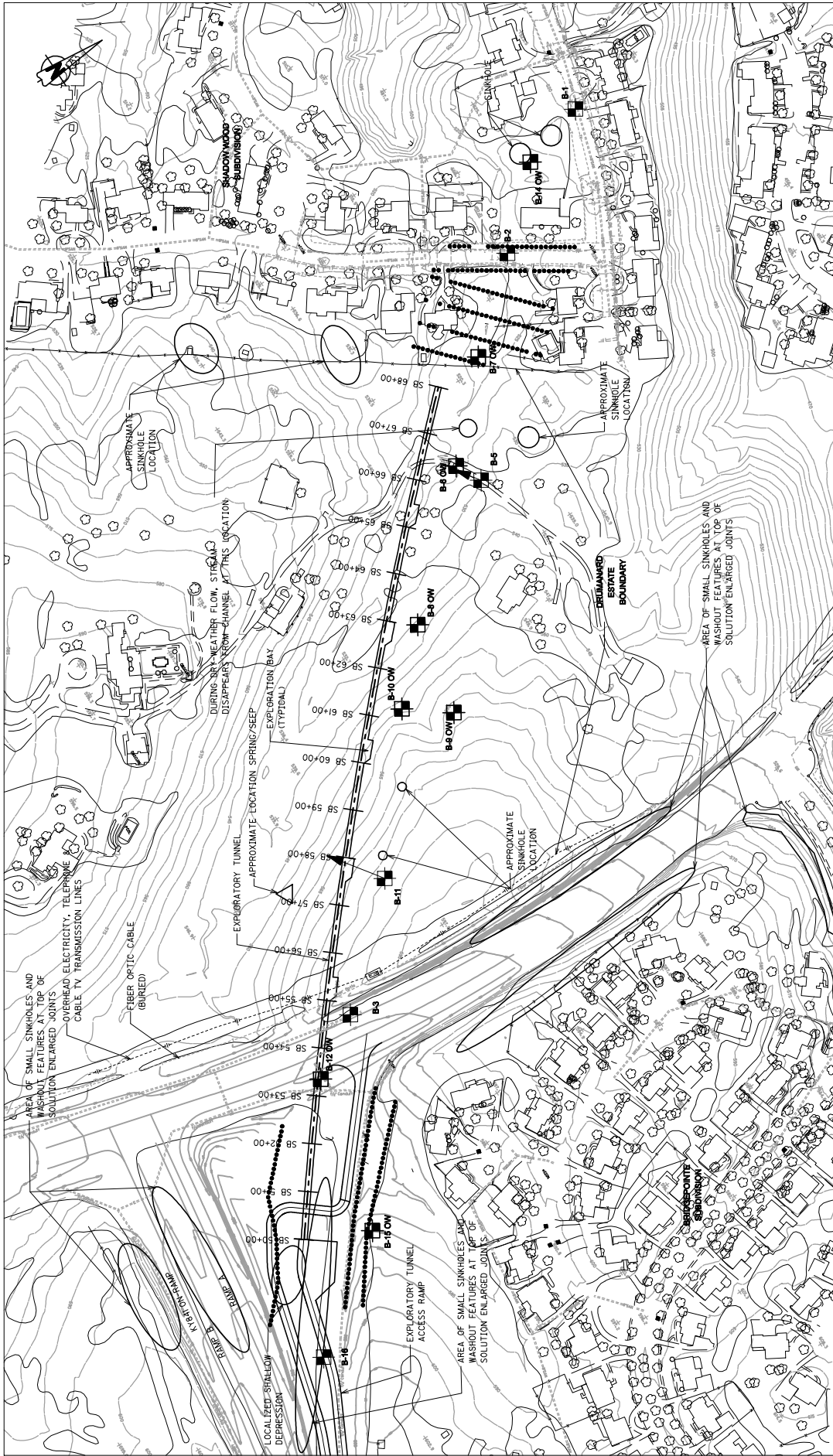
Dolomite, limestone, shale, and mudstone. Dolomite, very fine- to fine-grained with medium- to coarse-grained beds near top locally, partly calcareous, sparsely fossiliferous; worm burrows, mud cracks, and ripple marks present; thin- to thick-bedded. Limestone, micrograined to coarse-grained, locally dolomitic, partly argillaceous and silty; commonly fossiliferous, abundant colonial corals; thin- to thick-bedded. Shale, calcareous, locally carbonaceous, partly dolomitic. Mudstone, commonly dolomitic, locally calcareous, occurs interbedded with other units; thin- to thick-bedded.



LOUISVILLE SOUTHERN INDIANA
OHIO RIVER BRIDGES PROJECT
KENTUCKY EAST END APPROACH TUNNEL

FIGURE 1
GEOTECHNICAL BASELINE REPORT
BORINGS AND MAPPED FEATURES PLAN

APRIL 2007



SYMBOLS: BORING GROUND WATER WELL

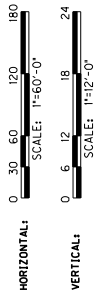
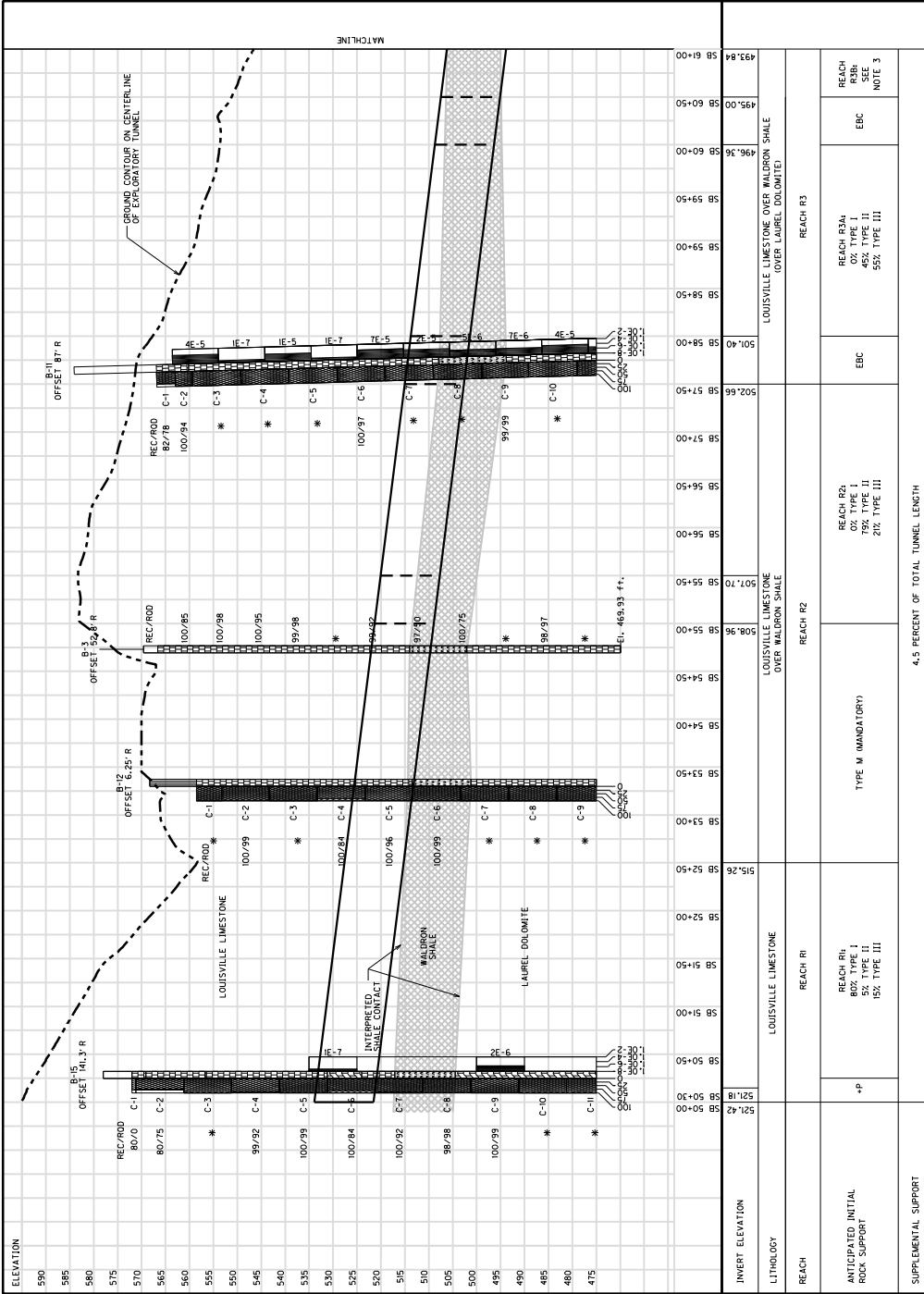
***** GEOPHYSICAL SURVEYS LOCATIONS PREVIOUSLY PERFORMED



LOUISVILLE SOUTHERN INDIANA
OHIO RIVER BRIDGES PROJECT
KENTUCKY EAST END APPROACH TUNNEL

FIGURE 2
GEOTECHNICAL BASELINE REPORT
GEOTECHNICAL PROFILE AND DETAILS
FOR TUNNEL AND EXPLORATION BAYS
SHEET 1 OF 2

APRIL 2007



NOTES:

- ONLY UPPER SECTION OF BOREHOLE RECORD SHOWN ON SECTION; FOR FULL DETAILS OF GEOTECHNICAL RECORDS REFER TO GOR TO DRAWING S-001, I, II, III AND M REFER FOR SUPPORT TYPE EBC REFER TO
- ANTICIPATED INITIAL TUNNEL SUPPORT IN TUNNEL REACH R3 EXCLUDING SUPPLEMENTAL SUPPORT TYPE III IN TWO TUNNEL SUB-SECTIONS R3A AND R3B.

LEGEND:

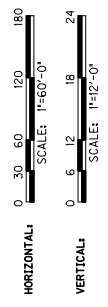
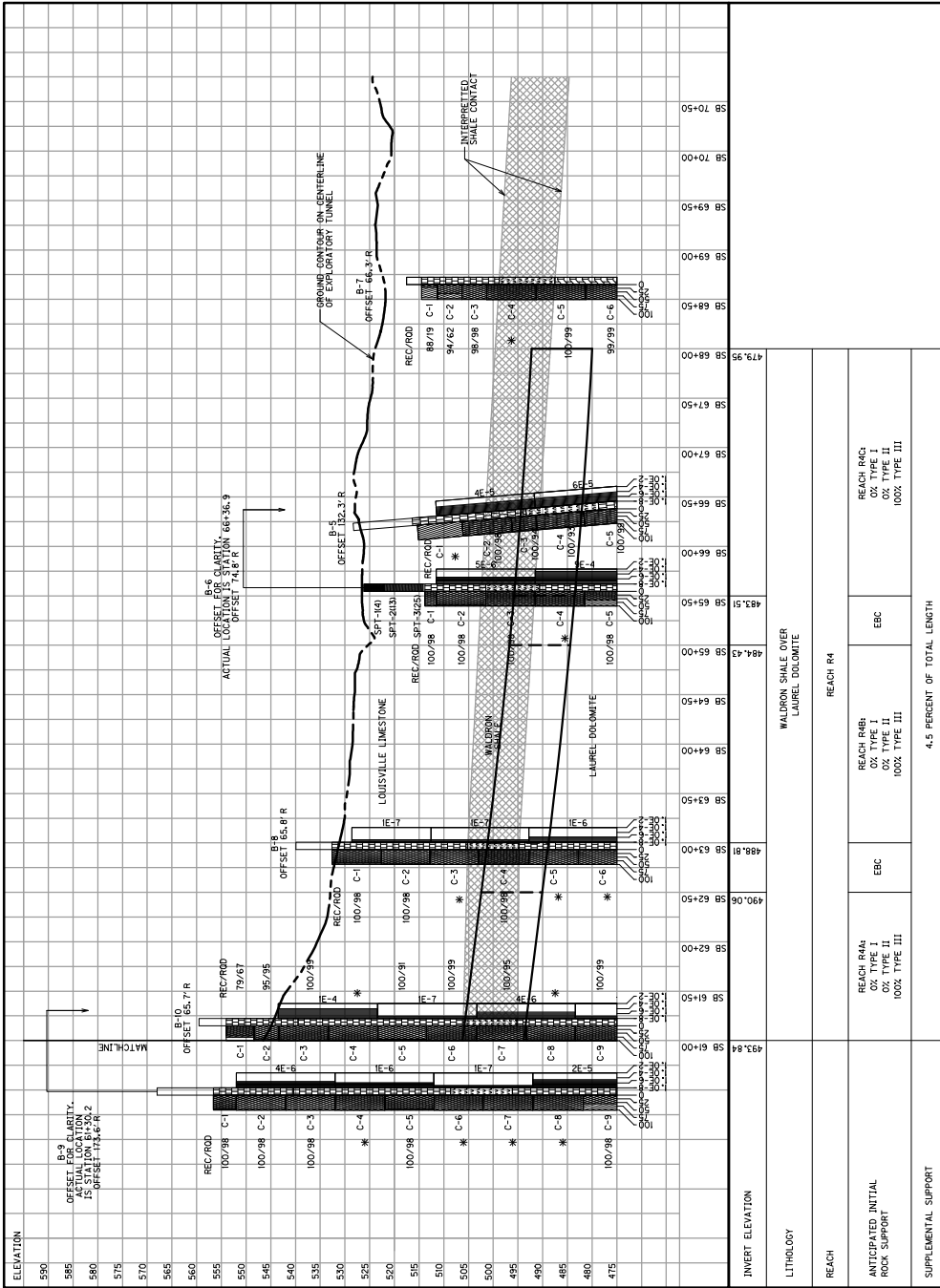
- +P - PRESCRIBED SUPPORT SPECIFIED FOR TUNNEL PORTAL AS PER DMC S-001 AND S-002.
- * C-# - DENOTES 100% CORE RECOVERY/100% ROD FOR NUMBERED CORE RUN
- B-24 - BORING NUMBER
- SOIL OVERBURDEN
- RECOVERY
- ROCK QUALITY DESIGNATION (ROD)
- LIMESTONE
- DOLOMITE
- SHALE - NON-DIPABLE
- SHALE - DIPABLE
- LEAN CLAY
- SILT
- FILL
- ASPHALT
- LEAN CLAY WITH SILT - SILT WITH TRACE CLAY
- C-2 - CORE SAMPLE NUMBER
- SPT-340 - SPLIT SPOON SAMPLE SAMPLE NUMBER (BLOWCOUNT)
- REC AND ROD (2)
- PERMEABILITY (CM/S)
- TE-5



LOUISVILLE SOUTHERN INDIANA
OHIO RIVER BRIDGES PROJECT
KENTUCKY EAST END APPROACH TUNNEL

FIGURE 3
GEOTECHNICAL BASELINE REPORT
GEOTECHNICAL PROFILE AND DETAILS
FOR TUNNEL AND EXPLORATION BAYS
SHEET 2 OF 2

APRIL 2007

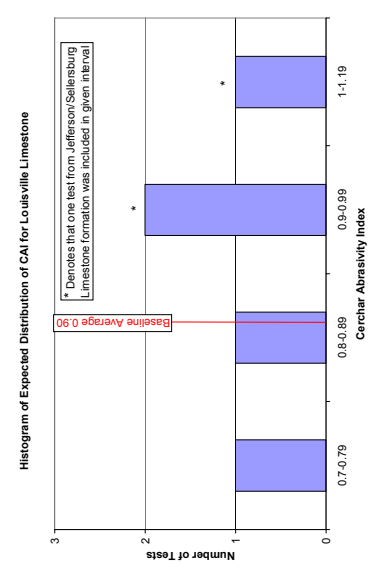
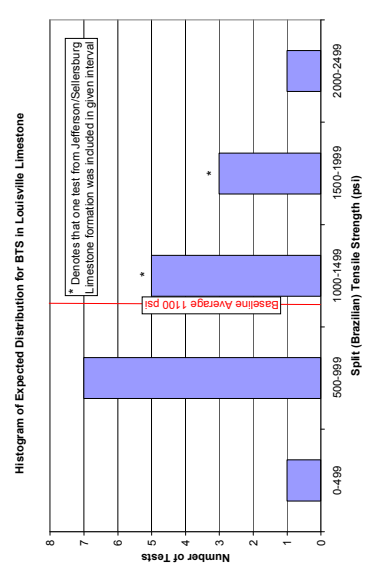
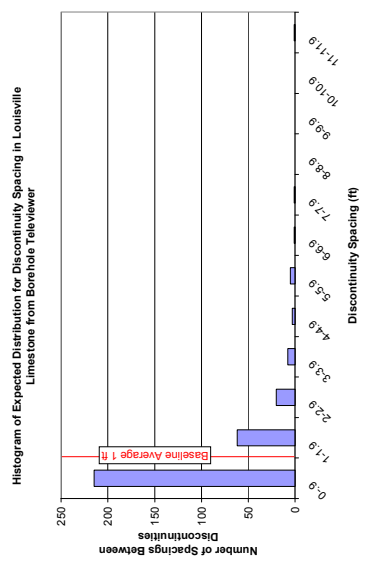
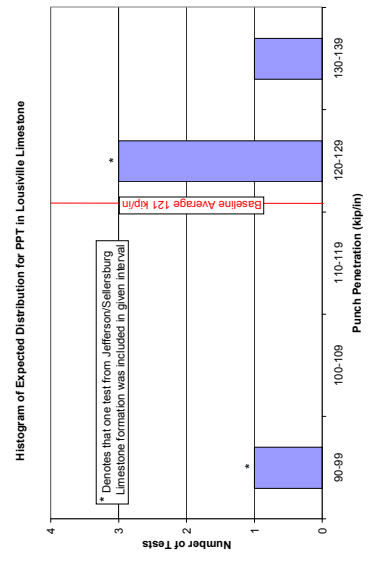
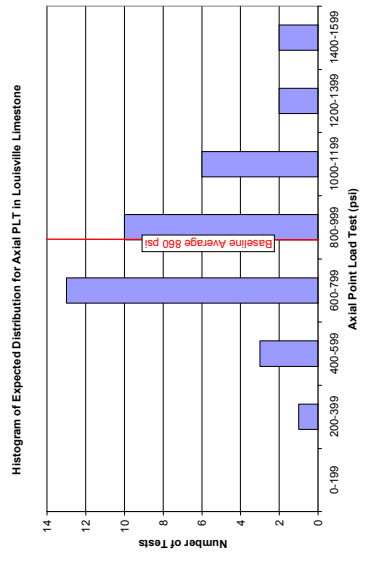
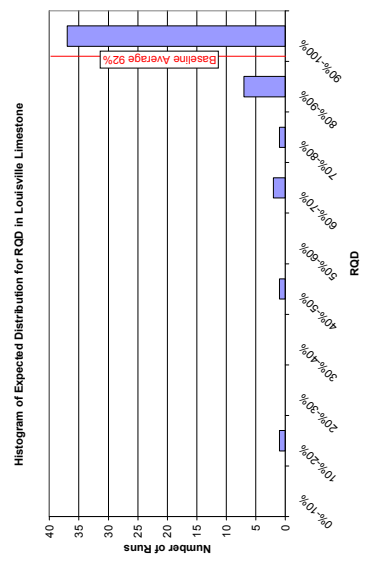
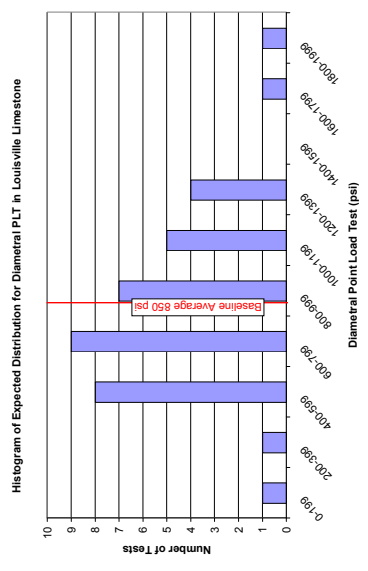
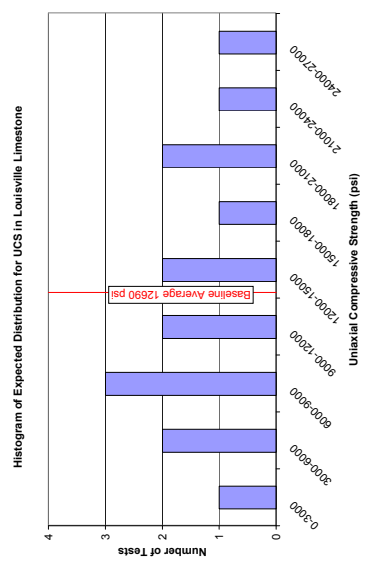




LOUISVILLE SOUTHERN INDIANA
OHIO RIVER BRIDGES PROJECT
KENTUCKY EAST END APPROACH TUNNEL

FIGURE 4
GEOTECHNICAL BASELINE REPORT
PROPERTIES OF LOUISVILLE LIMESTONE

APRIL 2007

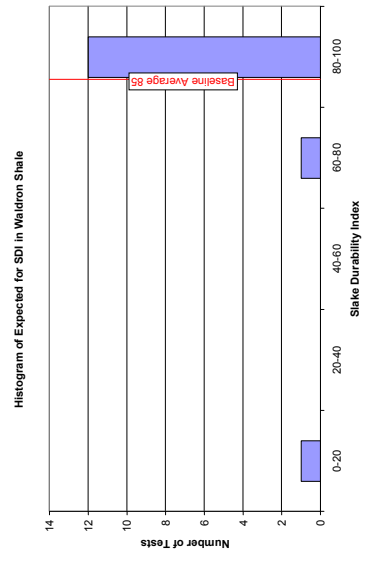
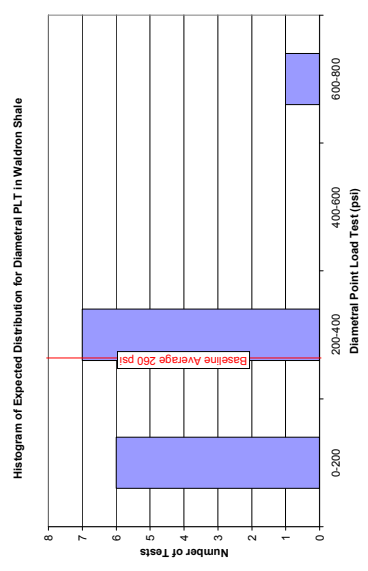
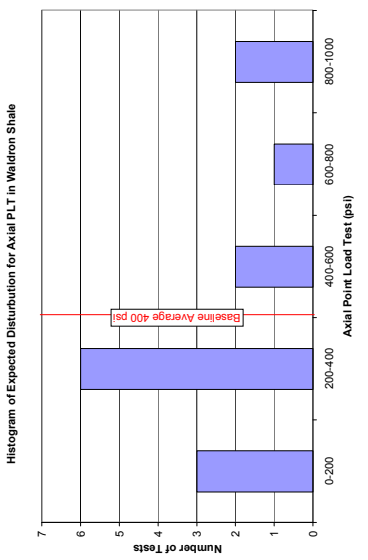
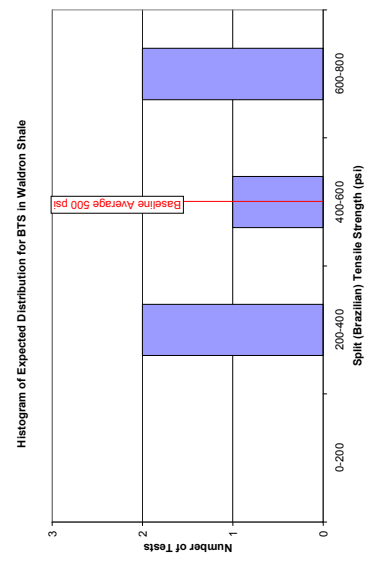
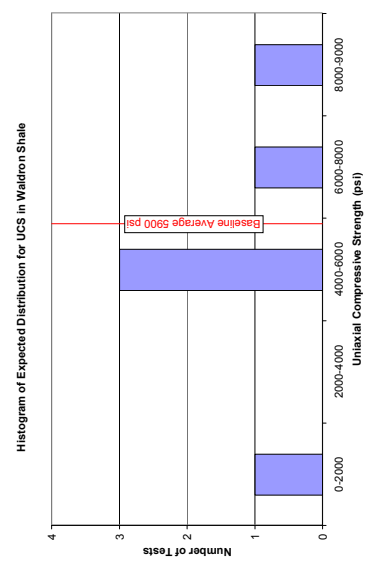
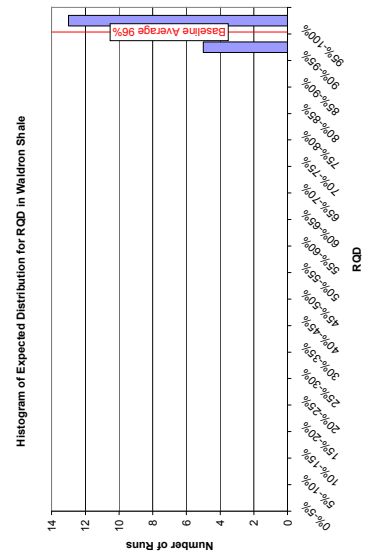
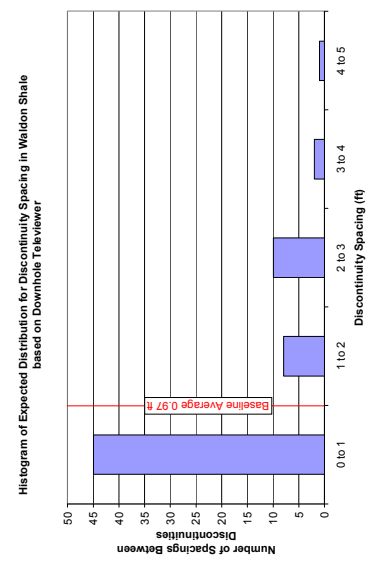




LOUISVILLE SOUTHERN INDIANA
OHIO RIVER BRIDGES PROJECT
KENTUCKY EAST END APPROACH TUNNEL

FIGURE 5
GEO TECHNICAL BASELINE REPORT
PROPERTIES OF WALDRON SHALE

APRIL 2007

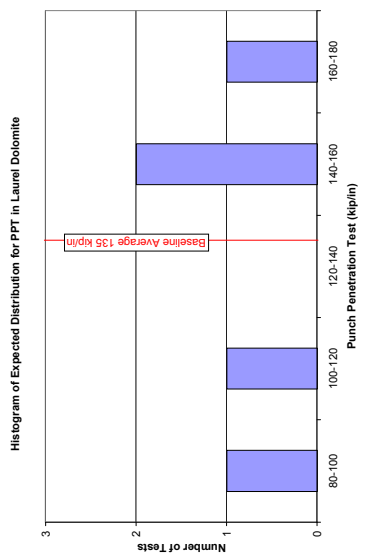
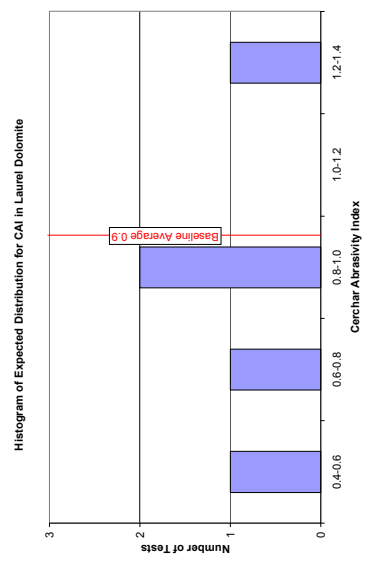
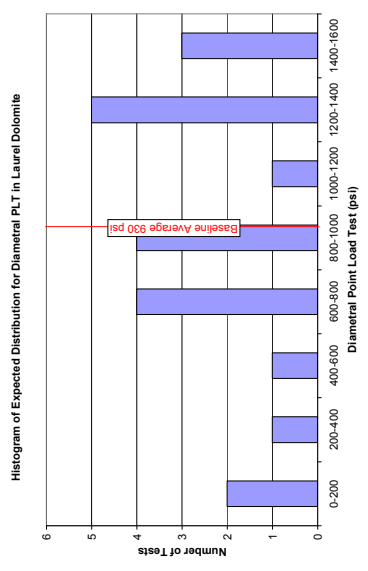
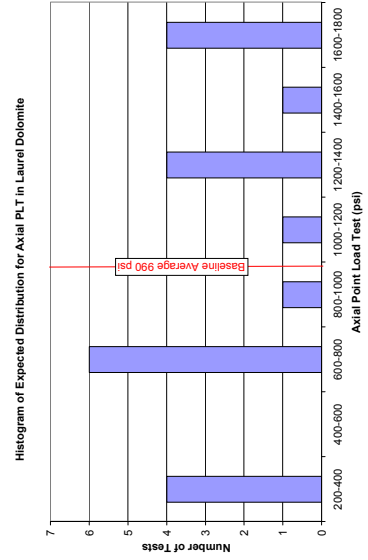
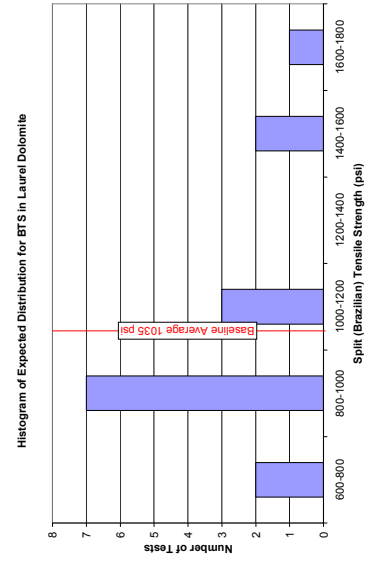
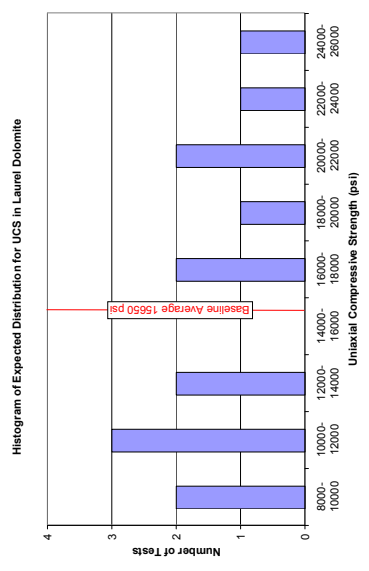
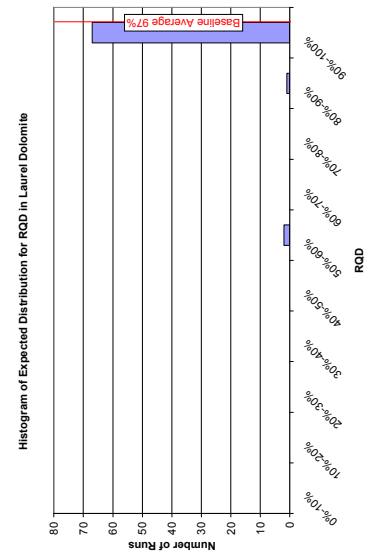
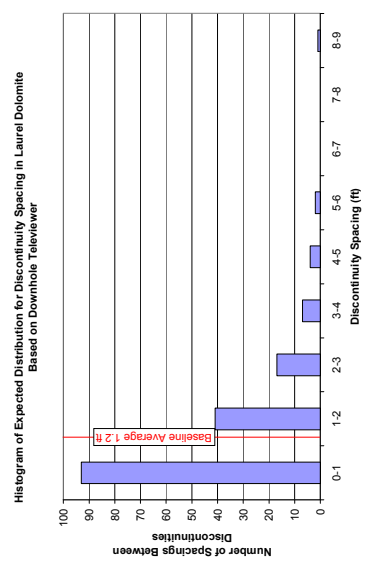




LOUISVILLE SOUTHERN INDIANA
OHIO RIVER BRIDGES PROJECT
KENTUCKY EAST END APPROACH TUNNEL

FIGURE 6
GEOTECHNICAL BASELINE REPORT
PROPERTIES OF LAUREL DOLOMITTE

APRIL 2007



PLS NAME: cbr Figure 06 Dolomite.dgn

N O T I C E

**DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
(NATIONWIDE PERMIT AUTHORIZATION)**

PROJECT: Jefferson County, Item No. 5-731.00/5-118

The Section 404 activities for this project have been permitted under the authority of the Department of the Army Nationwide Permit Number 14. In order for this authorization to be valid, the attached conditions must be followed. The contractor shall post a copy of this Nationwide Permit in a conspicuous location at the project site for the duration of construction and comply with the general conditions as required.

To more readily expedite construction, the contractor may elect to alter the design or perform the work in a manner different from what was originally proposed and specified. Prior to commencing such alternative work, the contractor shall obtain **written** permission from the Division of Construction and the Corps of Engineers. A copy of any request to the Corps of Engineers to alter this proposal and subsequent responses shall be forwarded to the Division of Environmental Analysis, DA Permit Coordinator, for office records and for informational purposes.



TRANSPORTATION CABINET

Frankfort, Kentucky 40622
www.kentucky.gov

Ernie Fletcher
Governor

Bill Nighbert
Secretary

Crystal Murray Ducker
Deputy Secretary

July 26, 2007

Department of the Army
Corps of Engineers
ATTN: Lee Anne Devine
Regulatory Branch
P.O. Box 59
Louisville, Kentucky 40201-0059

SUBJECT: Department of the Army Permit, Letter of Notification
Jefferson County, Louisville Bridges Exploratory Tunnel
Item No. 5-118.00(5-731),

Dear Ms. Devine:

The Kentucky Transportation Cabinet (KYTC) respectfully notifies the U.S Army Corps of Engineers by submission of this letter that impacts to waters of the U.S. will occur as a result of the referenced project. The project will entail the placement of 72 linear feet of rip rap along an intermittent/ephemeral channel. The letting date for this project is scheduled August of 2007 with construction projected to begin soon after.

We have reviewed the impacts associated with this project and find that they meet the provisions of Nationwide permit No. 13. The project will require the placement of 72 linear feet of rip rap for stabilization due to the outflow of channel from a sedimentation pond. This will impact 0.01 acres of waters of the U.S. There are no impacts to ephemeral, intermittent or perennial streams greater than 300' in length or that have an impact area over 0.1 acres in size to waters of the U.S. There are no wetlands located within the project corridor nor will any special aquatic sites be impacted by this project; therefore no stream or wetland mitigation is proposed.

This project originally received a NW 14 on Jan. 11, 2007 applied for by Lochner. That permit has since expired. I have included the original permit application and permit in this package. Upon my review of these impacts I believe that the activity matches the language of approved activities under NW 13 however; there is a 77' culvert above this area that has been in place for some time now and perhaps this is why it was issued a NW

14. Regardless, the impacts associated with this project are below the notification thresholds of either a NW 13 or NW 14.

Section 106 of the National Historic Preservation Act has been addressed through consultation with the KY SHPO. This part of the project is part of much larger project and it has been extensively surveyed. It was found that this particular stream impact would have no affect on historic or archaeological sites. Please find the enclosed documentation.

Section 7 of the Endangered Species Act has been addressed through consultation with the US Fish and Wildlife Service and concurrence was granted that the project will no effect any federally listed endangered species. Please find the enclosed documentation.

If you have any questions or need additional information, please contact me at 502-564-7250 or by email: Danny.Peake@ky.gov or Wayna Roach for cultural or historic questions at the same number.

Sincerely,



Daniel R. Peake
Division of Environmental Analysis
Kentucky Transportation Cabinet



United States Department of the Interior

FISH AND WILDLIFE SERVICE

3761 Georgetown Road
Frankfort, Kentucky 40601

MAY 29 AM 6:19

May 25, 2007

Mr. David Waldner
Department of Environmental Analysis
Kentucky Transportation Cabinet
200 Mero Street
Frankfort, Kentucky 40662

Subject: FWS Log No. 2007-B-0904, KYTC Item No. 5-118
Louisville Bridges Exploratory Tunnel, Species Effects Determination for *Myotis sodalis*, *Myotis grisescens*, *Pleurobema clava*, *Cyprogenia stegaria*, *Potamilus capax*, *Plethobasus cooperianus*, *Obovaria retusa*, *Lampsilis abrupta*, *Trifolium stoloniferum*, *Nicrophorus americanus*, and *Sterna antillarum*
Jefferson County, Kentucky

Dear Mr. Waldner:

Thank you for your letter and enclosures dated May 8, 2007 requesting our concurrence with your findings regarding threatened and endangered species for the above referenced project. The information provided addresses only the proposed exploratory tunnel construction activities. It is our understanding that impacts associated with other aspects of construction planned for this project are to be addressed in a separate document at a later date. Fish and Wildlife Service (Service) biologists have reviewed the information provided and offer the following comments with respect to your request.

According to the information provided, the majority of the proposed construction activities will occur underground. Excess material associated with construction activities is to be disposed of in areas addressed in previous consultations. A habitat assessment was performed on April 3, 2007 for the above referenced species. Findings of this assessment determined that no habitat existed and/or would be impacted within the disturbance limits of the proposed project. Information supporting this determination was provided within the coordination letter, attachment, and personal communication with a DEA biologist on May 9, 2007.

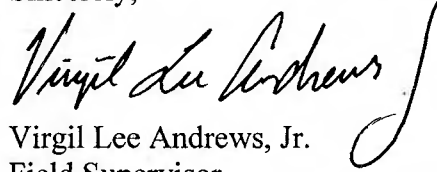
Based on the information provided, the Service concurs that the proposed action will have "no effect" the *Myotis sodalis*, *Myotis grisescens*, *Pleurobema clava*, *Cyprogenia stegaria*, *Potamilus capax*, *Plethobasus cooperianus*, *Obovaria retusa*, *Lampsilis abrupta*, *Trifolium stoloniferum*, *Nicrophorus americanus*, and *Sterna antillarum*. In view of this, we believe that the requirements of section 7 of the Endangered Species Act have been fulfilled for the proposed action. However, your obligations under section 7 must be reconsidered if: (1) new information reveals that the proposed action may affect listed species in a manner or to an extent not previously considered, (2) the proposed action is subsequently modified to include activities

TAKE PRIDE
IN AMERICA 

which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

Thank you for the opportunity to comment on this action. If you have any questions or if we can be of further assistance, please contact Phil DeGarmo at (502) 695-0468 x110.

Sincerely,

A handwritten signature in black ink that reads "Virgil Lee Andrews, Jr." The signature is written in a cursive style with a large, sweeping flourish at the end.

Virgil Lee Andrews, Jr.
Field Supervisor



TRANSPORTATION CABINET

Frankfort, Kentucky 40622
www.kentucky.gov

Ernie Fletcher
Governor

Bill Nighbert
Secretary

Marc Williams
Commissioner of Highways

July 13, 2007

Jeff Vlach
Environmental Commitments Manager
Community Transportation Solutions, General Engineering
Consultant (CTS-GEC)
8126 Castleton Road
Indianapolis, Indiana 46250

SUBJECT: **Archaeological Report:** *Archaeological Monitoring of Geotechnical Borings for the Proposed Kennedy Bridges Interchange Area of the Ohio River Bridges Project in Jefferson County, Kentucky (State Item No. 5-118.00).* By Jay Stottman and Steven R. Ahler

Dear Mr. Vlach:

Enclosed please find two (2) copies of the subject report. Within the SDC 1 project right of way, 57 geotechnical bores were monitored by archaeologists. The report assessed 23 bores to have high probability of archaeological deposits, while 34 were relegated to low probability status. The results will be integrated into the Archaeological GIS currently under construction for SDC 1. Final determinations of probability will be made in the Archaeological GIS. The SHPO concurs with these recommendations and a copy of their letter is enclosed.

If you require additional report copies, or if you have any concerns or questions, please feel free to contact Wayna Roach at (502) 564-7250.

Very truly yours,

A handwritten signature in black ink, appearing to read "David M. Waldner".

David M. Waldner, P. E. Director
Division of Environmental Analysis

enclosures
DMW/wlr

cc: George Jones (FHWA)
Anthony Goodman (FHWA)
Jadie Tomlinson (KYTC)
Matt Bullock (District 5)
Central Files, Archaeology files



**COMMERCE CABINET
KENTUCKY HERITAGE COUNCIL**

Ernie Fletcher
Governor

The State Historic Preservation Office
300 Washington Street
Frankfort, Kentucky 40601
Phone (502) 564-7005
Fax (502) 564-5820
www.kentucky.gov

George Ward
Secretary

June 4, 2007

Mr. David M. Waldner
Division of Environmental Analysis
Transportation Cabinet
200 Mero Street
Frankfort, Kentucky 40622

Re: *Archaeological Monitoring of Geotechnical Borings for the Proposed Kennedy Bridges Interchange Area of the Ohio River Bridges Project in Jefferson County, Kentucky (Item 5-118.00) By Richard L Herndon and Tanya Faberson*

Dear Mr. Waldner:

The State Historic Preservation Office has reviewed the above referenced revised archaeological report with the KYTC. Our staff considers the report to be sufficient. Within the project right-of-way, 57 bore holes were monitored for the presence or absence of archaeological deposits. Areas of high archaeological potential were noted in 23 bore holes; 34 bore holes revealed areas of low archaeological potential and 5.2 acres of the project area contained hazardous material and was too dangerous to investigate fully. This information will be integrated with the Bridges Archaeological GIS database that is currently under development to help determine where more archaeological work should occur.

Should you have any questions, feel free to contact Lori Stahlgren of my staff at (502) 564-7005, extension 118.

Sincerely,

A handwritten signature in cursive script that reads "Donna M. Neary".

Donna M. Neary, Director
Kentucky Heritage Council and
State Historic Preservation Officer

cc: George Crothers
Richard L Herndon



TRANSPORTATION CABINET
DIVISION OF
ENVIRONMENTAL ANALYSIS

MAY 29 10 32 AM '01

Education, Arts and Humanities Cabinet

KENTUCKY HERITAGE COUNCIL

The State Historic Preservation Office

Paul E. Patton
Governor
Marlene M. Helm
Cabinet Secretary

David L. Morgan
Executive Director and
SHPO

May 21, 2001

Mr. John L. Mettelle, Jr.
Acting Director
Division of Environmental Analysis
Transportation Cabinet
125 Holmes Street
Frankfort, KY 40622

Dear Mr. Mettelle:

The State Historic Preservation Office has received for review and approval an archaeological report entitled "An Archaeological Reconnaissance of the Proposed Ohio River Bridges Project in Jefferson County, Kentucky" by Matthew D. Reynolds, Steven D. Creasman, and R. Berle Clay with contributions by James T. Kirkwood.

The reconnaissance was undertaken to determine the potential that the various alternates had for impacting cultural resources. During the course of the reconnaissance, five previously unknown sites (15Jf677, 15Jf678, 15Jf679, 15Jf680, and 15Jf683) were recorded. One previously recorded archaeological site (15Jf591) was noted but not reexamined since it had been determined ineligible for National Register listing in the past. Two sites (15Jf679 and 15Jf683) are associated with standing structures listed on the National Register of Historic Places and are considered contributing elements to these National Register properties (Rosewell Plantation and Allison-Barrickman). The remaining three sites (15Jf677, 15Jf678, and 15Jf680) are all considered potentially eligible for listing in the National Register of Historic Places. All five of the archaeological sites would require additional investigations depending on which alternate is selected. Further, the authors note that an intensive Phase I archaeological survey will be necessary when the preferred alternates are selected. I concur with their assessment of the five sites and recommendations for additional investigations.

We look forward to reviewing the intensive Phase I archaeological survey report and future consultation for this project. Should you have any questions, feel free to contact Charles Hockensmith of my staff at (502) 564-7005.

Sincerely,

David L. Morgan, Director
Kentucky Heritage Council and
State Historic Preservation Officer

cc: Mr. Charles M. Niquette

300 Washington Street
Frankfort, Kentucky 40601
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Telephone (502) 564-7005
FAX (502) 564-5820
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**COMMERCE CABINET
KENTUCKY HERITAGE COUNCIL**

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Governor

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George Ward
Secretary

April 5, 2007

Mr. David Waldner, P.E., Director
Division of Environmental Analysis
Kentucky Transportation Cabinet
200 Mero Street, 5th Floor
Frankfort, KY 40622

Re: Revised Effect Determination for the Witherspoon Street Extension, Louisville-Southern Indiana Ohio River Bridges Project, Jefferson County, Kentucky (Item No. 5-118.00)

Dear Mr. Waldner:

The State Historic Preservation Office has received for review and approval maps illustrating the proposed alignment for the Witherspoon Street extension for the above-referenced project. The Witherspoon Street extension is adjacent to the Butchertown Historic District, which was listed in the National Register of Historic Places (NRHP) in 1976.

The alignment currently under consideration, and presented in the second figure provided to this office, does not extend within the NRHP boundaries for Butchertown. This alignment, referred to as Option 1B on the map, differs slightly from the Witherspoon Street extension as included in the Final Environmental Impact Statement (FEIS). It is the determination of this office that Option 1B would have **No Effect** on the Butchertown Historic District.

If you have questions regarding these comments, please contact Janie-Rice Brother of my staff at (502) 564-7005, extension 121.

Sincerely,

Donna M. Neary, Executive Director
Kentucky Heritage Council and
State Historic Preservation Officer

Cc: Wayna Roach, KYTC-DEA



DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
P.O. BOX 59
LOUISVILLE, KENTUCKY 40201-0059
FAX: (502) 315-6677
<http://www.lrl.usace.army.mil/>

January 18, 2007.

Operations Division
Regulatory Branch (South)
ID No. LRL-2007-30-pjl

Mr. Bart Bryant
Louisville-Southern Indiana Ohio River Bridges Project
Bi-State Management Team
Lochner
1040 Monarch Street, Suite 300
Lexington, Kentucky 40513

Dear Mr. Bryant:

This is in response to your request for authorization to place quarried rock as channel lining along 72 linear feet of an intermittent tributary of Harrods Creek in Jefferson County, Kentucky. The purpose of the work would be to complete work on an exploratory roadway tunnel associated with the Ohio River Bridges Project. The information supplied by you was reviewed to determine whether a Department of the Army (DA) permit will be required under the provisions of Section 404 of the Clean Water Act.

Your project is considered a discharge of backfill or bedding material for a road crossing. The project is authorized under the provisions of 33 CFR 330 A Nationwide Permit (NWP) No. 14, Linear Transportation Crossings, as published in the Federal Register January 15, 2002. Under the provisions of this authorization you must comply with the enclosed:

1. Terms for Nationwide Permit No. 14;
2. Nationwide Permit General Conditions; and
3. Water Quality Certification (WQC) Conditions for Nationwide Permit No. 14 dated March 17, 2002, issued by the Kentucky Division of Water.

Once you obtain your certification, or if no application was required, you may proceed with the project without further contact or verification from us.

This verification is valid until the NWP is modified, reissued, or revoked. All of the existing NWPs are scheduled to be modified, reissued, or revoked prior to March 18, 2007. It is incumbent upon you to remain informed of changes to the NWPs. We will issue a public notice when the NWPs are reissued. Furthermore, if you commence or are

under contract to commence this activity before the date that the relevant nationwide permit is modified or revoked, you will have twelve (12) months from the date of the modification or revocation of the NWP to complete the activity under which the present terms and conditions of this nationwide permit.

The enclosed Compliance Certification should be signed and returned when the project is completed. If your project is not completed within the above time limit, or if your project is modified you must contact us for another permit determination. A copy of this letter is being sent to the coordinating agencies (see enclosure for addresses).

If you have any questions, please contact this office by writing to the above address, ATTN: CELRL-OP-FN, or by calling me at (502) 315-6693. All correspondence pertaining to this matter should refer to our ID No. LRL-2007-30-pjl.

Sincerely,



Pam Loefler
Regulatory Specialist
Regulatory Branch

Enclosures

TERMS FOR NATIONWIDE PERMIT NO. 14
Linear Transportation Projects

Activities required for the construction, expansion, modification, or improvement of linear transportation crossings (e.g., highways, railways, trails, airport runways, and taxiways) in waters of the US, including wetlands, if the activity meets the following criteria:

a. This NWP is subject to the following acreage limits:

(1) For linear transportation projects in non-tidal waters, provided the discharge does not cause the loss of greater than 1/2-acre of waters of the US; or

(2) For linear transportation projects in tidal waters, provided the discharge does not cause the loss of greater than 1/3-acre of waters of the US.

b. The permittee must notify the District Engineer in accordance with General Condition 13 if any of the following criteria are met:

(1) The discharge causes the loss of greater than 1/10-acre of waters of the US; or

(2) There is a discharge in a special aquatic site, including wetlands;

c. The notification must include a compensatory mitigation proposal to offset permanent losses of waters of the US to ensure that those losses result only in minimal adverse effects to the aquatic environment and a statement describing how temporary losses will be minimized to the maximum extent practicable;

d. For discharges in special aquatic sites, including wetlands, and stream riffle and pool complexes, the notification must include a delineation of the affected special aquatic sites;

e. The width of the fill is limited to the minimum necessary for the crossing;

f. This permit does not authorize stream channelization, and the authorized activities must not cause more than minimal changes to the hydraulic flow characteristics of the stream, increase flooding, or cause more than minimal degradation of water quality of any stream (see General Conditions 9 and 21);

g. This permit cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars; and

h. The crossing is a single and complete project for crossing waters of the US. Where a road segment (i.e., the shortest segment of a road with independent utility that is part of a larger project) has multiple crossings of streams (several single and complete projects) the Corps will consider whether it should use its discretionary authority to require an Individual Permit. (Sections 10 and 404)

Note: Some discharges for the construction of farm roads, forest roads, or temporary roads for moving mining equipment may be eligible for an exemption from the need for a Section 404 permit (see 33 CFR 323.4).

NATIONWIDE PERMIT CONDITIONS

General Conditions: The following general conditions must be followed in order for any authorization by a NWP to be valid:

1. **Navigation.** No activity may cause more than a minimal adverse effect on navigation.
2. **Proper Maintenance.** Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.
3. **Soil Erosion and Sediment Controls.** Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.
4. **Aquatic Life Movements.** No activity may substantially disrupt the life-cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams must be installed to maintain low flow conditions.
5. **Equipment.** Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.
6. **Regional and Case-By-Case Conditions.** The activity must comply with any regional conditions, which may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state or tribe in its Section 401 Water Quality Certification and Coastal Zone Management Act consistency determination.
7. **Wild and Scenic Rivers.** No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible mix inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, US Forest Service, Bureau of Land Management, US Fish and Wildlife Service).
8. **Tribal Rights.** No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.
9. **Water Quality.** (a) In certain states and tribal lands an individual 401 water quality certification must be obtained or waived. (See 33 CFR 330.4(d)).
(b) For NWPs 12, 14, 17, 18, 32, 39, 40, 42, 43, and 44, where the state or tribal 401 certification (either generally or individually) does not require or improve a water quality management measure, the permittee must provide water quality management measures that will ensure that the authorized work does not result in more than minimal degradation of water quality (or the Corps determines that compliance with state or local standards, where applicable, will ensure no more than minimal adverse effect on water quality). An important component of a water quality management plan includes storm water management that minimizes degradation of the downstream aquatic systems including water quality (Refer to General Condition 21 for storm water management requirements). Another important component of water quality management plan is the establishment and maintenance of vegetated buffers next to open waters, including streams (Refer to General Condition 19 for vegetated buffer requirements for the NWPs). This condition is only applicable to projects that have the potential to affect water quality. While appropriate measures must be taken, in most cases it is unnecessary to conduct detailed studies to identify such measures or to require monitoring.
10. **Coastal Zone Management.** In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see 33 CFR 330.4(d)).
11. **Endangered Species.** (a) No activity is authorized under any NWP, which is likely to jeopardize the continued existence of a threatened or endangered species, or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which will destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or is located in the designated critical habitat and shall not begin work on the activity until notified by the District Engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized. For activities that may affect Federally-listed endangered or threatened species or designated critical habitat, the notification must include the name(s) of the endangered or threatened species that may be affected by the proposed work or that utilize the designated critical habitat that may be affected by the proposed work. As a result of formal or informal consultation with the FWS or NMFS, the District Engineer may add species-specific regional endangered species conditions to the NWPs.

(b) Authorization of an activity by a nationwide permit does not authorize the 'take' of a threatened or endangered species as defined under the Federal Endangered Species Act. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with 'incidental take' provisions, etc.) from the US Fish and Wildlife Service or the National Marine Fisheries Service, both lethal and non-lethal 'takes' of protected species are in violation of the Endangered Species Act. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the US Fish and Wildlife Service and National Marine Fisheries Service or their World Wide Web pages at <http://www.fws.gov/r9endspp/endspp.html> and http://www.nfms.noaa.gov/prot_res/overview/es.html, respectively.

12. Historic Properties. No activity, which may affect historic properties, listed, or eligible for listing, in the National Register of Historic Places is authorized, until the DE has complied with the provisions of 33 CFR part 325, Appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places; and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places (see 33 CFR 330.4(g)). For activities that may affect historic properties listed in, or eligible for listing in, the National Register of Historic Places, the notification must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property.

13. Notification. (a) Timing: Where required by the terms of the NWP, the prospective permittee must notify the District Engineer with a preconstruction notification (PCN) as early as possible. The District Engineer must determine if the PCN is complete within 30 days of the date of receipt and can request the additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the District Engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the District Engineer. The prospective permittee shall not begin the activity:

(1) Until notified in writing by the District Engineer that the activity may proceed under the NWP with any special conditions imposed by the District or Division Engineer; or

(2) If notified in writing by the District or Division Engineer that an individual permit is required; or

(3) Unless 45 days have passed from the District Engineer's receipt of the complete notification and the prospective permittee has not received written notice from the District or Division Engineer. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Notification: The notification must be in writing and include the following information:

(1) Name, address, and telephone numbers of the prospective permittee;

(2) Location of the proposed project;

(3) Brief description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), regional general permit(s), or individual permit(s) Used or intended to be Used to authorize any part of the proposed project or any related activity. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP (Sketches usually clarify the project and when provided result in a quicker decision); and

(4) For NWPs 7, 12, 14, 18, 21, 34, 38, 39, 40, 41, 42, and 43, the PCN must also include a delineation of affected special aquatic sites, including wetlands, vegetated shallows (e.g., submerged aquatic vegetation, seagrass beds), and riffle and pool complexes (see paragraph 13(f));

(5) For NWP 7, Outfall Structures and Maintenance, the PCN must include information regarding the original design capacities and configurations of those areas of the facility where maintenance dredging or excavation is proposed.

(6) For NWP 14, Linear Transportation Projects, the PCN must include a compensatory mitigation proposal to offset permanent losses of waters of the US and a statement describing how temporary losses of waters of the US will be minimized to the maximum extent practicable.

(7) For NWP 21, Surface Coal Mining Activities, the PCN must include an Office of Surface Mining (OSM) or state-approved mitigation plan. To be authorized by this NWP, the District Engineer must determine that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are minimal both individually and cumulatively and must notify the project sponsor of this determination in writing;

(8) For NWP 27, Stream and Wetland Restoration Activities, the PCN must include documentation of the prior condition of the site that will be reverted by the permittee.

(9) For NWP 29, Single-Family Housing, the PCN must also include:

(i) Any past use of this NWP by the individual permittee and/or the permittee's spouse;

(ii) A statement that the single-family housing activity is for a personal residence of the permittee;

(iii) A description of the entire parcel, including its size, and a delineation of wetlands. For the purpose of this NWP, parcels of land measuring 1/4 acre or less will not require a formal on-site delineation. However, the applicant shall provide an indication of

where the wetlands are and the amount of wetlands that exists on the property. For parcels greater than 1/4 acre in size, a formal wetland delineation must be prepared in accordance with the current method required by the Corps. (See paragraph 13(f));

(iv) A written description of all land (including, if available, legal descriptions) owned by the prospective permittee and/or the prospective permittee's spouse, within a one mile radius of the parcel, in any form of ownership (including any land owned as a partner, corporation, joint tenant, co-tenant, or as a tenant-by-the-entirety) and any land on which a purchase and sale agreement or other contract for sale or purchase has been executed;

(10) For NWP 31, Maintenance of Existing Flood Control Facilities, the prospective permittee must either notify the District Engineer with a PCN prior to each maintenance activity or submit a five year (or less) maintenance plan. In addition, the PCN must include all of the following:

(i) Sufficient baseline information so as to identify the approved channel depths and configurations and existing facilities. Minor deviations are authorized, provided the approved flood control protection or drainage is not increased;

(ii) A delineation of any affected special aquatic sites, including wetlands; and,

(iii) Location of the dredged material disposal site.

(11) For NWP 33, Temporary Construction, Access, and Dewatering, the PCN must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources.

(12) For NWP's 39, 43, and 44, the PCN must also include a written statement to the District Engineer explaining how avoidance and minimization of losses of waters of the US were achieved on the project site.

(13) For NWP 39 and NWP 42, the PCN must include a compensatory mitigation proposal that offsets unavoidable losses of waters of the US or justification explaining why compensatory mitigation should not be required. For discharges that cause the loss of greater than 300 linear feet of an intermittent stream bed, to be authorized, the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;

(14) For NWP 40 (Agricultural Activities), the PCN must include a compensatory mitigation proposal to offset losses of waters of the US. This NWP does not authorize the relocation of greater than 300 linear-feet of existing serviceable drainage ditches constructed in non-tidal streams unless, for drainage ditches constructed in intermittent non-tidal streams, the District Engineer waives this criterion in writing, and the District Engineer has determined that the project complies with all terms and conditions of this NWP, and that any adverse impacts of the project on the aquatic environment are minimal, both individually and cumulatively;

(15) For NWP 43 (Stormwater Management Facilities), the PCN must include, for the construction of new stormwater management facilities, a maintenance plan (in accordance with state and local requirements, if applicable) and a compensatory mitigation proposal to offset losses of waters of the US. For discharges that cause the loss of greater than 300 linear feet of an intermittent streambed, to be authorized, the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;

(16) For NWP 44, Mining Activities, the PCN must include a description of all waters of the US adversely affected by the project, a description of measures taken to minimize adverse effects to waters of the US, a description of measures taken to comply with the criteria of the NWP, and a reclamation plan (for aggregate mining activities in isolated waters and non-tidal wetlands adjacent to headwaters and any hard rock/mineral mining activities).

(17) For activities that may adversely affect Federally-listed endangered or threatened species, the PCN must include the name(s) of those endangered or threatened species that may be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work.

(18) For activities that may affect historic properties listed in, or eligible for listing in, the National Register of Historic Places, the PCN must state which historic property may be affected by the proposed work or include vicinity map indicating the location of the historic property.

(c) Form of Notification: The standard individual permit application form (Form ENG 4345) may be Used as the notification but must clearly indicate that it is a PCN and must include all of the information required in (b) (1)-(19) of General Condition 13. A letter containing the requisite information may also be used.

(d) District Engineer's Decision: In reviewing the PCN for the proposed activity, the District Engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. The prospective permittee may, optionally, submit a proposed mitigation plan with the PCN to expedite the process and the District Engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed work are minimal. If the District Engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, the District Engineer will notify the permittee and include any conditions the District Engineer deems necessary. Any compensatory mitigation proposal must be approved by the District Engineer prior to commencing work. If the prospective permittee is required to submit a compensatory mitigation proposal with the PCN, the proposal may be either conceptual or detailed. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the District Engineer will expeditiously review the proposed compensatory mitigation plan. The District Engineer must review the plan within 45 days of receiving a complete PCN and determine whether the conceptual or specific proposed mitigation would ensure no more than minimal

adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the District Engineer to be minimal, the District Engineer will provide a timely written response to the applicant stating that the project can proceed under the terms and conditions of the nationwide permit. If the District Engineer determines that the adverse effects of the proposed work are more than minimal, then he will notify the applicant either: (1) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (2) that the project is authorized under the NWP subject to the applicant's submission of a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level; or (3) that the project is authorized under the NWP with specific modifications or conditions. Where the District Engineer determines that mitigation is required in order to ensure no more than minimal adverse effects on the aquatic environment, the activity will be authorized within the 45-day PCN period, including the necessary conceptual or specific mitigation or a requirement that the applicant submit a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level. When conceptual mitigation is included, or a mitigation plan is required under item (2) above, no work in waters of the US will occur until the District Engineer has approved a specific mitigation plan.

(e) **Agency Coordination:** The District Engineer will consider any comments from Federal and State agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse effects on the aquatic environment to a minimal level.

For activities requiring notification to the District Engineer that result in the loss of greater than 1/2 acre of waters of the US, the District Engineer will, upon receipt of a notification, provide immediately (e.g., via facsimile transmission, overnight mail, or other expeditious manner), a copy to the appropriate offices of the Fish and Wildlife Service, State natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO), and, if appropriate, the National Marine Fisheries Service. With the exception of NWP 37, these agencies will then have 10 calendar days from the date the material is transmitted to telephone or fax the District Engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the District Engineer will wait an additional 15 calendar days before making a decision on the notification. The District Engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency, except as provided below. The District Engineer will indicate in the administrative record associated with each notification that the resource agencies' concerns were considered. As required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act, the District Engineer will provide a response to National Marine Fisheries Service within 30 days of receipt of any Essential Fish Habitat conservation recommendations. Applicants are encouraged to provide the Corps multiple copies of notifications to expedite agency notification.

(f) **Wetlands Delineations:** Wetland delineations must be prepared in accordance with the current method required by the Corps. For NWP 29 see paragraph (b)(9)(iii) for parcels less than 1/4 acre in size. The permittee may ask the Corps to delineate the special aquatic site. There may be some delay if the Corps does the delineation. Furthermore, the 45-day period will not start until the wetland delineation has been completed and submitted to the Corps, where appropriate.

14. Compliance Certification. Every permittee who has received a nationwide permit verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter. The certification will include: (a) A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions; (b) A statement that any required mitigation was completed in accordance with the permit conditions; and (c) The signature of the permittee certifying the completion of the work and mitigation.

15. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the US authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the US for the total project cannot exceed 1/3 acre.

16. Water Supply Intakes. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in the proximity of a public water supply intake except where the activity is for repair of the public water supply intake structures or adjacent bank stabilization.

17. Shellfish Beds. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWP 4.

18. Suitable Material. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.) and material Used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

19. **Mitigation.** The District Engineer will consider the factors discussed below when determining the acceptability of appropriate and practicable mitigation necessary to offset adverse effects on the aquatic environment that are more than minimal.

(a) The project must be designed and constructed to avoid and minimize adverse effects to waters of the US to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing or compensating) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland impacts requiring a PCN, unless the District Engineer determines in writing that some other form of mitigation would be more environmentally appropriate and provides a project-specific waiver of this requirement. Consistent with National policy, the District Engineer will establish a preference for restoration of wetlands as compensatory mitigation, with preservation used only in exceptional circumstances.

(d) Compensatory mitigation (i.e., replacement or substitution of aquatic resources for those impacted) will not be used to increase the acreage losses allowed by the acreage limits of some of the NWP's. For example, 1/4 -acre of wetlands cannot be created to change a 3/4 -acre loss of wetlands to a 1/2 -acre loss associated with NWP 39 verification. However, 1/2 -acre of created wetlands can be used to reduce the impacts of a 1/2 -acre loss of wetlands to the minimum impact level in order to meet the minimal impact requirement associated with NWP's.

(e) To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of the overall project purposes. Examples of mitigation that may be appropriate and practicable include, but are not limited to: reducing the size of the project; establishing and maintaining wetland or upland vegetated buffers to protect open waters such as streams; and replacing losses of aquatic resource functions and values by creating, restoring, enhancing, or preserving similar functions and values, preferably in the same watershed.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the establishment, maintenance, and legal protection (e.g., easements, deed restrictions) of vegetated buffers to open waters. In many cases, vegetated buffers will be the only compensatory mitigation required. Vegetated buffers should consist of native species. The width of the vegetated buffers required will address documented water quality or aquatic habitat loss concerns. Normally, the vegetated buffer will be 25 to 50 feet wide on each side of the stream, but the District Engineers may require slightly wider vegetated buffers to address documented water quality or habitat loss concerns. Where both wetlands and open waters exist on the project site, the Corps will determine the appropriate compensatory mitigation (e.g., stream buffers or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where vegetated buffers are determined to be the most appropriate form of compensatory mitigation, the District Engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland impacts.

(g) Compensatory mitigation proposals submitted with the "notification" may be either conceptual or detailed. If conceptual plans are approved under the verification, then the Corps will condition the verification to require detailed plans be submitted and approved by the Corps prior to construction of the authorized activity in waters of the US.

(h) Permittees may propose the use of mitigation banks, in-lieu fee arrangements or separate activity-specific compensatory mitigation. In all cases that require compensatory mitigation, the mitigation provisions will specify the party responsible for accomplishing and/or complying with the mitigation plan.

20. Spawning Areas. Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., excavate, fill, or smother downstream by substantial turbidity) of an important spawning area are not authorized.

21. Management of Water Flows. To the maximum extent practicable, the activity must be designed to maintain preconstruction downstream flow conditions (e.g., location, capacity, and flow rates). Furthermore, the activity must not permanently restrict or impede the passage of normal or expected high flows (unless the primary purpose of the fill is to impound waters) and the structure or discharge of dredged or fill material must withstand expected high flows. The activity must, to the maximum extent practicable, provide for retaining excess flows from the site, provide for maintaining surface flow rates from the site similar to preconstruction conditions, and provide for not increasing water flows from the project site, relocating water, or redirecting water flow beyond preconstruction conditions. Stream channelizing will be reduced to the minimal amount necessary, and the activity must, to the maximum extent practicable, reduce adverse effects such as flooding or erosion downstream and upstream of the project site, unless the activity is part of a larger system designed to manage water flows. In most cases, it will not be a requirement to conduct detailed studies and monitoring of water flow.

This condition is only applicable to projects that have the potential to affect waterflows. While appropriate measures must be taken, it is not necessary to conduct detailed studies to identify such measures or require monitoring to ensure their effectiveness. Normally, the Corps will defer to state and local authorities regarding management of water flow.

22. Adverse Effects From Impoundments. If the activity, including structures and work in navigable waters of the US or discharge of dredged or fill material, creates an impoundment of water, adverse effects on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized to the maximum extent practicable.

23. **Waterfowl Breeding Areas.** Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

24. **Removal of Temporary Fills.** Any temporary fills must be removed in their entirety and the affected areas returned to their preexisting elevation.

25. **Designated Critical Resource Waters.** Critical resource waters include, NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for Federally listed threatened and endangered species, coral reefs, State natural heritage sites, and outstanding national resource waters or other waters officially designated by a State as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment. The District Engineer may also designate additional critical resource waters after notice and opportunity for comment.

(a) Except as noted below, discharges of dredged or fill material into waters of the US are not authorized by NWP's 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, and 44 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters. Discharges of dredged or fill materials into waters of the US may be authorized by the above NWP's in National Wild and Scenic Rivers if the activity complies with General Condition 7. Further, such discharges may be authorized in designated critical habitat for Federally listed threatened or endangered species if the activity complies with General Condition 11 and the US Fish and Wildlife Service or the National Marine Fisheries Service has concurred in a determination of compliance with this condition.

(b) For NWP's 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with General Condition 13, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The District Engineer may authorize activities under these NWP's only after he determines that the impacts to the critical resource waters will be no more than minimal.

26. **Fills Within 100-Year Floodplains.** For purposes of this General Condition, 100-year floodplains will be identified through the existing Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps or FEMA-approved local floodplain maps.

(a) *Discharges in Floodplain; Below Headwaters.* Discharges of dredged or fill material into waters of the US within the mapped 100-year floodplain, below headwaters (i.e. five cfs), resulting in permanent above-grade fills, are not authorized by NWP's 39, 40, 42, 43, and 44.

(b) *Discharges in Floodway; Above Headwaters.* Discharges of dredged or fill material into waters of the US within the FEMA or locally mapped floodway, resulting in permanent above-grade fills, are not authorized by NWP's 39, 40, 42, and 44.

(c) The permittee must comply with any applicable FEMA-approved state or local floodplain management requirements.

27. **Construction Period.** For activities the Corps has not verified that and the project were commenced or under contract to commence by the expiration date of the NWP (or modification or revocation date), the work must be completed within 12- months after such date (including any modification that affects the project).

For activities that have been verified and the project was commenced or under contract to commence within the verification period, the work must be completed by the date determined by the Corps.

For projects that have been verified by the Corps, an extension of a Corps approved completion date maybe requested. This request must be submitted at least one month before the previously approved completion date.

D. Further Information

1. District engineers have authority to determine if an activity complies with the terms and conditions of an NWP.
2. NWP's do not obviate the need to obtain other Federal, State, or local permits, approvals, or authorizations required by law.
3. NWP's do not grant any property rights or exclusive privileges.
4. NWP's do not authorize any injury to the property or rights of others.
5. NWP's do not authorize interference with any existing or proposed Federal project.

Section 10 Special Condition: The permittee understands and agrees that, if future operations by the US require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or its authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structure work or obstructions caused thereby, without expense to the US. No claim shall be made against the US on account of any such removal or alteration.

JAMES E. BICKFORD
SECRETARY



PAUL E. PATTON
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
14 REILLY RD
FRANKFORT KY 40601

General Certification--Nationwide Permit #14
Road Crossings

This General Certification is issued on March 17, 2002, in conformity with the requirements of Section 401 of the Clean Water Act of 1977, as amended (33USC 1314), as well as Kentucky Statute KRS 224.16-070.

The Commonwealth of Kentucky hereby certifies under Section 401 of the Clean Water Act (CWA) that it has reasonable assurances that applicable water quality standards under Kentucky Administrative Regulations Title 401, Chapter 5, established pursuant to Sections 301, 302, 304, 306 and 307 of the CWA, will not be violated for the activity covered under 33 CFR Part 330 Appendix A(B) (14), namely road crossings provided that the following conditions are met:

1. Individual road culvert or bridges, either for public or private purposes, that exceed 200 linear feet in width shall require an individual Water Quality Certification.
2. Stream and riparian impacts will be limited to the minimum necessary to construct the road crossing. For the purpose of this General Certification, streams are defined as a solid or dashed blue line on the most recent version of USGS 1:24,000 topographic map.
3. All equipment access and excavations within a stream, necessary to complete a road crossing project, shall be done in such a manner as to prevent degradation of Waters of the Commonwealth. Temporary equipment crossing structures shall be constructed with sufficient pipe capacity so as not to impede normal stream flow.
4. Stream bed gravel and rock shall not be used for construction material.
5. The stream crossing structure shall be constructed in such a manner that does not impede the movement of aquatic organisms. The bottom of any culverts shall be level with the stream bed.
6. This General Certification shall not apply to those waters of the Commonwealth identified as Outstanding State Resource Waters, Exceptional Waters or Cold Water Aquatic Habitat Waters, as designated by the Division of Water. An individual Water Quality Certification will be required for projects in these waters.
7. Stream impacts covered under this nationwide permit and undertaken by those persons defined as an agricultural operation under the Agricultural Water Quality Act must be completed in compliance with the Kentucky Agricultural Water Quality Plan.



Compliance Certification:

Permit Number: LRL-2007-30-pjl

Name of Permittee: Kentucky Transportation Cabinet

Date of Issuance: January 18, 2007

Upon completion of the activity authorized by this permit and any mitigation required by this permit, sign this certification and return it to the following address:

U.S. Army Corps of Engineers
CELRL-OP-FN
P.O. Box 59
Louisville, Kentucky 40201

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Signature of Permittee

Date

ADDRESSES FOR COORDINATING AGENCIES

Mr. David W. Morgan
Environmental and Public Division of Water
Division of Water
14 Reilly Road
Frankfort, KY 40601

Office of the Director
Louisville Metro Planning and Design
444 South 5th Street, Suite 300
Louisville, KY 40202-4313

Mr. David Johnson
Metropolitan Sewer District
700 West Liberty Street
Louisville, KY 40202



Louisville-Southern Indiana Ohio River Bridges Project

October 18, 2006

Department of the Army
Corps of Engineers-Louisville District
ATTN: (CELRL-OP-FS)
Lee Anne Devine

Regulatory Branch
600 Dr. Martin Luther King
Louisville, KY 40202

SUBJECT: Request for Department of Army Permit
Louisville-Southern Indiana Ohio River Bridge Project (LSIORBP)
Louisville Metro Area, Jefferson County
Exploratory Tunnel and Access Ramp Plans

Ms. Devine:

Submitted is a request to construct the above reference project under the provisions of Nationwide Permit No. 14 "Linear Transportation Crossings". This project involves the construction of an access ramp in order to complete construction of an exploratory tunnel. Its purpose is to provide geotechnical information that is necessary to complete the roadway tunnel design. On September 6, 2003 the Federal Highway Administration approved the Record of Decision in the Final Environmental Impact Statement. We feel that the proposed activities meet the criteria listed for a nationwide permit and ask that this project be reviewed for your approval.

At the present, this project is scheduled for a Spring construction letting. All approvals must accompany the Notice to Contractors. To ensure that any and all conditions are appropriately incorporated into the plans, the permit authorization must be provided before letting.

Enclosed is a location map, summary sheet and reduced plan sheets/drawings.

Additionally, we would like to clarify that this is a Kentucky Transportation Cabinet permit application. Due to the complexity and size of the overall project, a Bi-State Management Team (BSMT) was created to oversee the project and its consultants. This permit application is on behalf of the Kentucky Transportation Cabinet and its Department of Environmental Analysis. Should you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,

Bart Bryant
KYTC Project Manager
Bi-State Management Team

Cc: DEA – John Dovak
CTS – Kevin Villier



LOCHNER

1040 Monarch Street, Ste. 300, Lexington, KY 40513
Tel (859) 224-4476 - Fax (859) 224-9828



SUMMARY OF SECTION 404 IMPACTS

Jefferson County, Louisville Metro Area

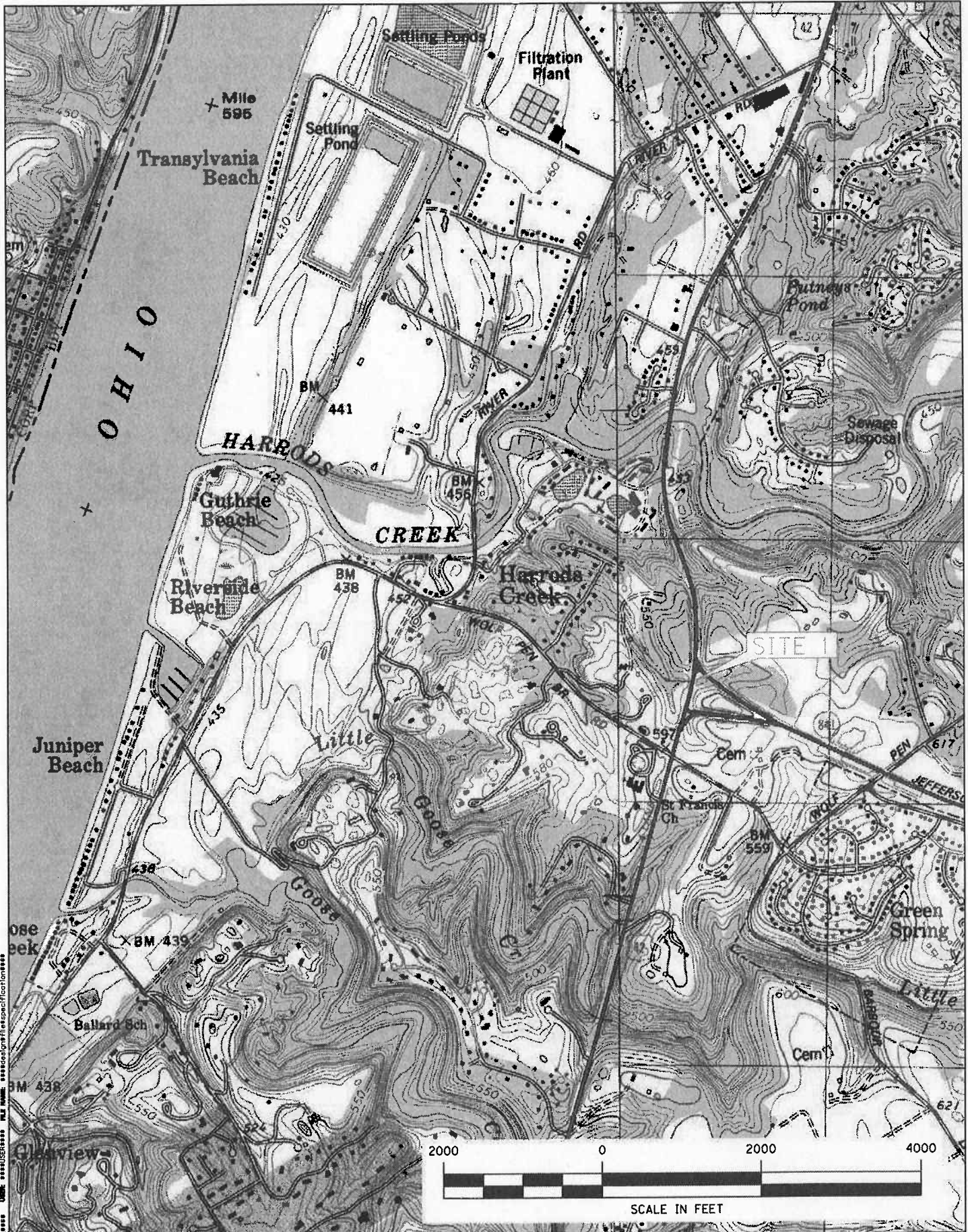
Item 5-118.xx

(See attached location map for sites)

This project involves the construction of an access ramp in order to complete construction of an exploratory tunnel. Its purpose is to provide geotechnical information that is necessary to complete the roadway tunnel design. On September 6, 2003 the Federal Highway Administration approved the Record of Decision in the Final Environmental Impact Statement. The coordinates for the project along US 42 are approximately 38°19'28.5" N 85 37'17" W (Coordinates located based upon Google Earth data). The work associated with the construction project will result in one impact (Site 1) that is expected to be a "Waters of the United States". It qualifies for authorization under Nationwide Permit No. 14.

Note: There are no special aquatic sites or wetlands impacted by this project.

1. RT. Sta. 12+25 (Access Ramp) – Cross drain 36" RCP. Existing 77 feet of culvert for an unnamed tributary of Harrods Creek will not be disturbed; however, approximately 72 linear feet of minor outlet channel will require stabilization due to the outflow channel from a sedimentation pond. The channel modifications will be lined with channel lining (quarried rock). The proposed stream impact is **72 feet** in length and **0.01 Acres** in area. The flow regime of the tributary is intermittent/ephemeral in nature with a watershed of **24.85 Acres**. The elevation at the inlet is 565.80' and outlet elevation is 560.92'.
(*Nationwide Permit No. 14*)



DATE: 08/04/2008 10:58:58 AM USER: JEFFERSON COUNTY GIS SPECIFICATION

**Kentucky
Transportation**

SITE: SITE 1 - ACCESS RAMP STA. 12+25

STREAM: UNNAMED TRIBUTARY

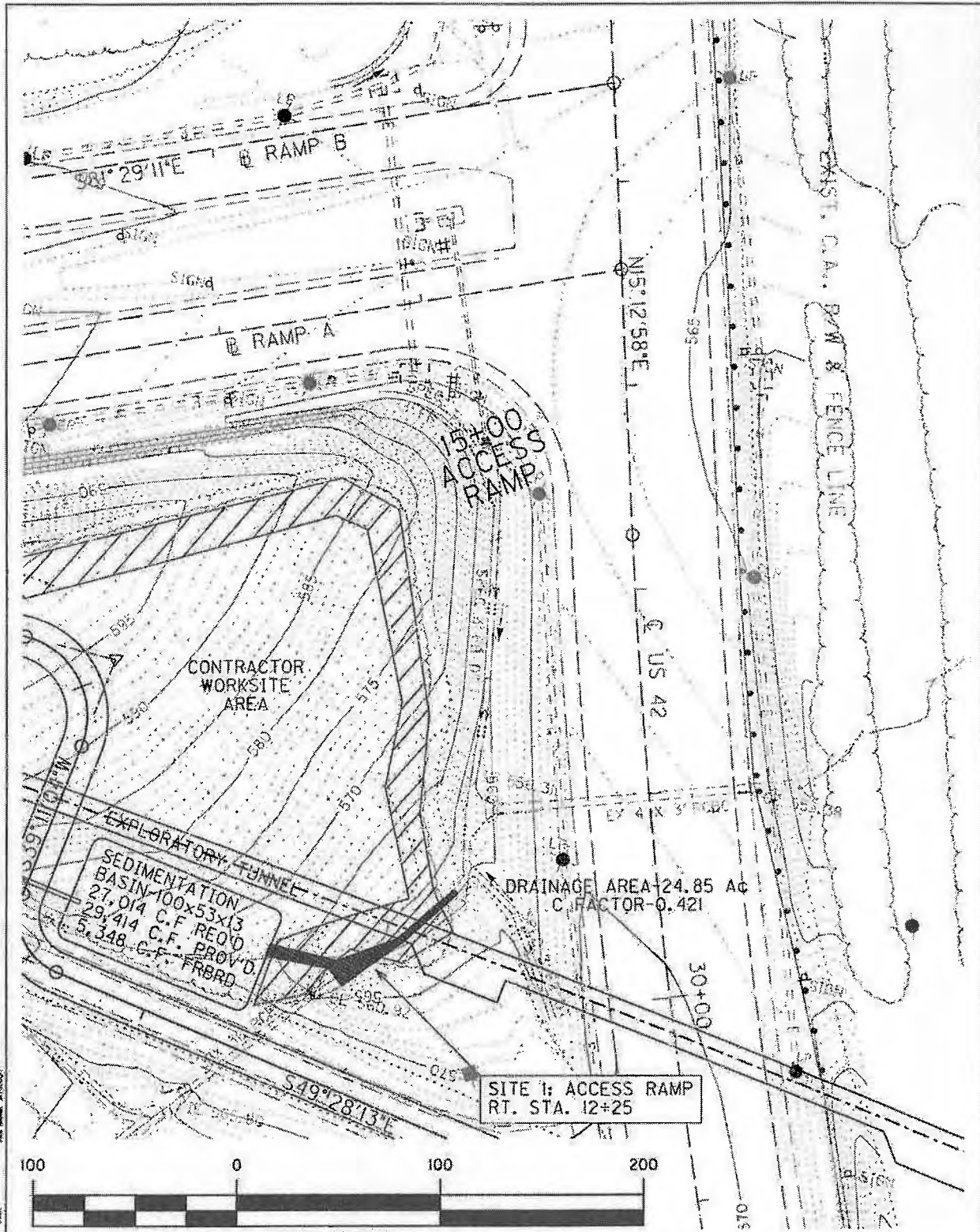
COUNTY: JEFFERSON

STATE: KENTUCKY

NEAR: PROSPECT

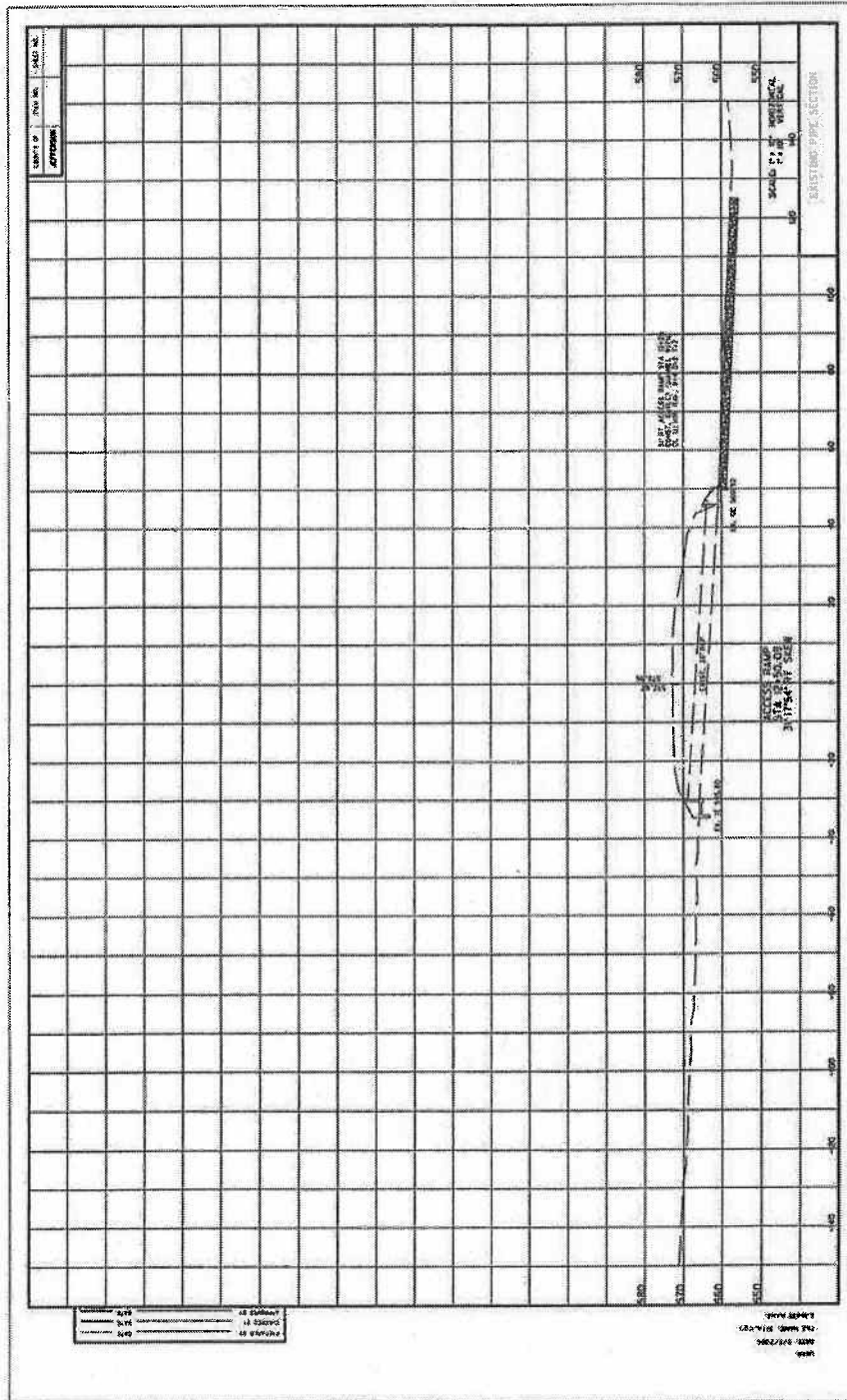
ITEM: 5-118.XX

SHEET:



Kentucky Transportation	SITE: SITE 1 - ACCESS RAMP STA. 12+25		STREAM: UNNAMED TRIBUTARY	
	COUNTY: JEFFERSON	STATE: KENTUCKY	NEAR: PROSPECT	ITEM: 5-118.XX

DATE: 03/27/2006



Kentucky Transportation	SITE: SITE 1 - ACCESS RAMP STA. 12+25		STREAM: UNNAMED TRIBUTARY	
	COUNTY: JEFFERSON	STATE: KENTUCKY	NEAR: PROSPECT	ITEM: 5-118.XX

KyTC BMP Plan for Project PCN ## - #####



Kentucky Transportation Cabinet

Highway District 5

And

_____ **(2), Construction**

**Kentucky Pollutant Discharge Elimination System
Permit KYR10**

Best Management Practices (BMP) plan

Groundwater protection plan

For Highway Construction Activities

For

**Louisville-Southern Indiana Ohio River Bridges
Project Exploratory Tunnel and Access Ramp**

Project: PCN ## - #####

KyTC BMP Plan for Project PCN ## - #####

Project information

Note – (1) = Design (2) = Construction (3) = Contractor

1. Owner – Kentucky Transportation Cabinet, District 5
2. Resident Engineer: (2)
3. Contractor name: (2)
Address: (2)

Phone number: (2)
Contact: (2)
Contractors agent responsible for compliance with the KPDES
permit requirements (3):
4. Project Control Number (2)
5. Route (Address) US 42 & KY 841
6. Latitude/Longitude (project mid-point) dd/mm/ss, dd/mm/ss 38/18/00
North, 85/35/00 West
7. County (project mid-point) Jefferson
8. Project start date (date work will begin): (2)
9. Projected completion date: (2)

KyTC BMP Plan for Project PCN ## - #####

A. Site description:

1. Nature of Construction Activity (from letting project description) Louisville-Southern Indiana Ohio River Bridges Project Exploratory Tunnel and Access Ramp
2. Order of major soil disturbing activities (2) and (3)
3. Projected volume of material to be moved 100,000 yd³
4. Estimate of total project area (acres) 3.2
5. Estimate of area to be disturbed (acres) 3.2
6. Post construction runoff coefficient will be included in the project drainage folder. Persons needing information pertaining to the runoff coefficient will contact the resident engineer to request this information.(1)
7. Data describing existing soil condition (1) & (2)
8. Data describing existing discharge water quality (if any) (1) & (2)
9. Receiving water name Harrods Creek

TMDLs and Pollutants of Concern in Receiving Waters: Harrods Creek was previously listed as an impaired stream. In 1995, it was added to Kentucky's TMDL program. A TMDL study conducted by the EPA and Kentucky Division of Water found that about three miles of lower Harrods Creek, which is largely backwater from the Ohio River, is in severe violation of water quality standards. According to the Kentucky Division of Water, the creek exhibits organic enrichment and also has low dissolved oxygen levels, which is attributed to packaging plant discharges. Another source may be the wastewater treatment plants located within and just upstream of the backwater areas.

10. Site map – Project layout sheet plus the erosion control sheets in the project plans that depict Disturbed Drainage Areas (DDAs) and related information. These sheets depict the existing project conditions with areas delineated by DDA (drainage area bounded by watershed breaks and right of way limits), the storm water discharge locations (either as a point discharge or as overland flow) and the areas that drain to each discharge point. These plans define the limits of areas to be disturbed and the location of control measures. Controls will be either site specific as designated by the designer or will be annotated by the contractor and

KyTC BMP Plan for Project PCN ## -

resident engineer before disturbance commences. The project layout sheet shows the surface waters and wetlands.

11. Potential sources of pollutants:

The primary source of pollutants is solids that are mobilized during storm events. Other sources of pollutants include oil/fuel/grease from servicing and operating construction equipment, concrete washout water, sanitary wastes and trash/debris. (3)

B. Sediment and Erosion Control Measures:

1. Plans for highway construction projects will include erosion control sheets that depict Disturbed Drainage Areas (DDAs) and related information. These plan sheets will show the existing project conditions with areas delineated by DDA within the right of way limits, the discharge points and the areas that drain to each discharge point. Project managers and designers will analyze the DDAs and identify Best Management Practices (BMPs) that are site specific. The balance of the BMPs for the project will be listed in the bid documents for selection and use by the contractor on the project with approval by the resident engineer.

Projects that do not have DDAs annotated on the erosion control sheets will employ the same concepts for development and managing BMP plans.

2. Following award of the contract, the contractor and resident engineer will annotate the erosion control sheets showing location and type of BMPs for each of the DDAs that will be disturbed at the outset of the project. This annotation will be accompanied by an order of work that reflects the order or sequence of major soil moving activities. The remaining DDAs are to be designated as "Do Not Disturb" until the contractor and resident engineer prepare the plan for BMPs to be employed. The initial BMP's shall be for the first phase (generally Clearing and Grubbing) and shall be modified as needed as the project changes phases. The BMP Plan will be modified to reflect disturbance in additional DDA's as the work progresses. All DDA's will have adequate BMP's in place before being disturbed.
3. As DDAs are prepared for construction, the following will be addressed for the project as a whole or for each DDA as appropriate:
 - Construction Access – This is the first land-disturbing activity. As soon as construction begins, bare areas will be stabilized with gravel and temporary mulch and/or vegetation.

KyTC BMP Plan for Project PCN ## -

- At the beginning of the project, all DDAs for the project will be inspected for areas that are a source of storm water pollutants. Areas that are a source of pollutants will receive appropriate cover or BMPs to arrest the introduction of pollutants into storm water. Areas that have not been opened by the contractor will be inspected periodically (once per month) to determine if there is a need to employ BMPs to keep pollutants from entering storm water.
- Clearing and Grubbing – The following BMP's will be considered and used where appropriate.
 - Leaving areas undisturbed when possible.
 - Silt basins to provide silt volume for large areas.
 - Silt Traps Type A for small areas.
 - Silt Traps Type C in front of existing and drop inlets which are to be saved
 - Diversion ditches to catch sheet runoff and carry it to basins or traps or to divert it around areas to be disturbed.
 - Brush and/or other barriers to slow and/or divert runoff.
 - Silt fences to catch sheet runoff on short slopes. For longer slopes, multiple rows of silt fence may be considered.
 - Temporary Mulch for areas which are not feasible for the fore mentioned types of protections.
 - Non-standard or innovative methods.
- Cut & Fill and placement of drainage structures - The BMP Plan will be modified to show additional BMP's such as:
 - Silt Traps Type B in ditches and/or drainways as they are completed
 - Silt Traps Type C in front of pipes after they are placed
 - Channel Lining
 - Erosion Control Blanket
 - Temporary mulch and/or seeding for areas where construction activities will be ceased for 21 days or more.
 - Non-standard or innovative methods
- Profile and X-Section in place – The BMP Plan will be modified to show elimination of BMP's which had to be removed and the addition of new BMP's as the roadway was shaped. Probably changes include:
 - Silt Trap Type A, Brush and/or other barriers, Temporary Mulch, and any other BMP which had to be removed for final grading to take place.
 - Additional Silt Traps Type B and Type C to be placed as final drainage patterns are put in place.
 - Additional Channel Lining and/or Erosion Control Blanket.
 - Temporary Mulch for areas where Permanent Seeding and Protection cannot be done within 21 days.
 - Special BMP's such as Karst Policy

KyTC BMP Plan for Project PCN ## -

- Finish Work (Paving, Seeding, Protect, etc.) – A final BMP Plan will result from modifications during this phase of construction. Probably changes include:
 - Removal of Silt Traps Type B from ditches and drainways if they are protected with other BMP's which are sufficient to control erosion, i.e. Erosion Control Blanket or Permanent Seeding and Protection on moderate grades.
 - Permanent Seeding and Protection
 - Placing Sod
 - Planting trees and/or shrubs where they are included in the project
- BMP's including Storm Water Management Devices such as velocity dissipation devices and Karst policy BMP's to be installed during construction to control the pollutants in storm water discharges that will occur after construction has been completed are: Two sediment basins will be constructed for the project.

C. Other Control Measures

1. No solid materials, including building materials, shall be discharged to waters of the commonwealth, except as authorized by a Section 404 permit.

2. Waste Materials

All waste materials that may leach pollutants (paint and paint containers, caulk tubes, oil/grease containers, liquids of any kind, soluble materials, etc.) will be collected and stored in appropriate covered waste containers. Waste containers shall be removed from the project site on a sufficiently frequent basis as to not allow wastes to become a source of pollution. All personnel will be instructed regarding the correct procedure for waste disposal. Wastes will be disposed in accordance with appropriate regulations. Notices stating these practices will be posted in the office.

3. Hazardous Waste

All hazardous waste materials will be managed and disposed of in the manner specified by local or state regulation. The contractor shall notify the Resident Engineer if there any hazardous wastes being generated at the project site and how these wastes are being managed. Site personnel will be instructed with regard to proper storage and handling of hazardous wastes when required. The Transportation Cabinet will file for generator, registration when appropriate, with the Division of Waste Management and advise the contractor regarding waste management requirements.

KyTC BMP Plan for Project PCN ## -

4. Spill Prevention

The following material management practices will be used to reduce the risk of spills or other exposure of materials and substances to the weather and/or runoff.

➤ **Good Housekeeping:**

The following good housekeeping practices will be followed onsite during the construction project.

- An effort will be made to store only enough product required to do the job
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure
- Products will be kept in their original containers with the original manufacturer's label
- Substances will not be mixed with one another unless recommended by the manufacturer
- Whenever possible, all of the product will be used up before disposing of the container
- Manufacturers' recommendations for proper use and disposal will be followed
- The site contractor will inspect daily to ensure proper use and disposal of materials onsite

➤ **Hazardous Products:**

These practices will be used to reduce the risks associated with any and all hazardous materials.

- Products will be kept in original containers unless they are not resealable
- Original labels and material safety data sheets (MSDS) will be reviewed and retained
- Contractor will follow procedures recommended by the manufacturer when handling hazardous materials
- If surplus product must be disposed of, manufacturers' or state/local recommended methods for proper disposal will be followed

The following product-specific practices will be followed onsite:

➤ **Petroleum Products:**

Vehicles and equipment that are fueled and maintained on site will be monitored for leaks, and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products onsite will be stored in tightly sealed containers, which are clearly labeled and will be protected from exposure to weather.

KyTC BMP Plan for Project PCN ## -

The contractor shall prepare an Oil Pollution Spill Prevention Control and Countermeasure plan when the project that involves the storage of petroleum products in 55 gallon or larger containers with a total combined storage capacity of 1,320 gallons. This is a requirement of 40 CFR 112.

This project (will / will not) (3) have over 1,320 gallons of petroleum products with a total capacity, sum of all containers 55 gallon capacity and larger.

➤ **Fertilizers:**

Fertilizers will be applied at rates prescribed by the contract, standard specifications or as directed by the resident engineer. Once applied, fertilizer will be covered with mulch or blankets or worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

➤ **Paints:**

All containers will be tightly sealed and stored indoors or under roof when not being used. Excess paint or paint wash water will not be discharged to the drainage or storm sewer system but will be properly disposed of according to manufacturers' instructions or state and local regulations.

➤ **Concrete Truck Washout:**

Concrete truck mixers and chutes will not be washed on pavement, near storm drain inlets, or within 75 feet of any ditch, stream, wetland, lake, or sinkhole. Where possible, excess concrete and wash water will be discharged to areas prepared for pouring new concrete, flat areas to be paved that are away from ditches or drainage system features, or other locations that will not drain off site. Where this approach is not possible, a shallow earthen wash basin will be excavated away from ditches to receive the wash water

➤ **Spill Control Practices**

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted. All personnel will be made aware of procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area. Equipment and materials will include as appropriate, brooms, dust pans, mops, rags, gloves, oil absorbents, sand, sawdust, and plastic and metal trash containers.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

KyTC BMP Plan for Project PCN ## -

- Spills of toxic or hazardous material will be reported to the appropriate state/local agency as required by KRS 224 and applicable federal law.
- The spill prevention plan will be adjusted as needed to prevent spills from reoccurring and improve spill response and cleanup.
- Spills of products will be cleaned up promptly. Wastes from spill clean up will be disposed in accordance with appropriate regulations.

D. Other State and Local Plans

This BMP plan shall include any requirements specified in sediment and erosion control plans, storm water management plans or permits that have been approved by other state or local officials. Upon submittal of the NOI, other requirements for surface water protection are incorporated by reference into and are enforceable under this permit (even if they are not specifically included in this BMP plan). This provision does not apply to master or comprehensive plans, non-enforceable guidelines or technical guidance documents that are not identified in a specific plan or permit issued for the construction site by state or local officials. Terms for Nationwide Permit No. 14; Nationwide Permit General Conditions; and Water Quality Certification Conditions for Nationwide Permit No. 14 dated March 17, 2002, issued by the Kentucky Division of Water.

E. Maintenance

1. The BMP plan shall include a clear description of the maintenance procedures necessary to keep the control measures in good and effective operating condition.
- Maintenance of BMPs during construction shall be a result of weekly and post rain event inspections with action being taken by the contractor to correct deficiencies.
 - Post Construction maintenance will be a function of normal highway maintenance operations. Following final project acceptance by the cabinet, district highway crews will be responsible for identification and correction of deficiencies regarding ground cover and cleaning of storm water BMPs. The project manager shall identify any BMPs that will be for the purpose of post construction storm water management with specific guidance for any non-routine maintenance. (1)

F. Inspections

Inspection and maintenance practices that will be used to maintain erosion and sediment controls:

KyTC BMP Plan for Project PCN ## -

- All erosion prevention and sediment control measures will be inspected at least once each week and following any rain of one-half inch or more.
- Inspections will be conducted by individuals that have received KyTC Grade Level II training or other qualification as prescribed by the cabinet that includes instruction concerning sediment and erosion control.
- Inspection reports will be written, signed, dated, and kept on file.
- Areas at final grade will be seeded and mulched within 14 days.
- Areas that are not at final grade where construction has ceased for a period of 21 days or longer and soil stock piles shall receive temporary mulch no later than 14 days from the last construction activity in that area.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of being reported.
- Built-up sediment will be removed from behind the silt fence before it has reached halfway up the height of the fence.
- Silt fences will be inspected for bypassing, overtopping, undercutting, depth of sediment, tears, and to ensure attachment to secure posts.
- Sediment basins will be inspected for depth of sediment, and built-up sediment will be removed when it reaches 70 percent of the design capacity and at the end of the job.
- Diversion dikes and berms will be inspected and any breaches promptly repaired. Areas that are eroding or scouring will be repaired and re-seeded / mulched as needed.
- Temporary and permanent seeding and mulching will be inspected for bare spots, washouts, and healthy growth. Bare or eroded areas will be repaired as needed.
- All material storage and equipment servicing areas that involve the management of bulk liquids, fuels, and bulk solids will be inspected weekly for conditions that represent a release or possible release of pollutants to the environment.

G. Non – Storm Water discharges

It is expected that non-storm water discharges may occur from the site during the construction period. Examples of non-storm water discharges include:

- Water from water line flushings.
- Water from cleaning concrete trucks and equipment.
- Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).

KyTC BMP Plan for Project PCN ## - #####

- Uncontaminated groundwater and rain water (from dewatering during excavation).

All non-storm water discharges will be directed to the sediment basin or to a filter fence enclosure in a flat vegetated infiltration area or be filtered via another approved commercial product.

H. Groundwater Protection Plan (3)

This plan serves as the groundwater protection plan as required by 401 KAR 5:037.

- Contractors statement: (3)

The following activities, as enumerated by 401 KAR 5:037 Section 2 that require the preparation and implementation of a groundwater protection plan, will or may be may be conducted as part of this construction project:

_____ 2. (e) land treatment or land disposal of a pollutant;

_____ 2. (f) Storing, ..., or related handling of hazardous waste, solid waste or special waste, ..., in tanks, drums, or other containers, or in piles, (This does not include wastes managed in a container placed for collection and removal of municipal solid waste for disposal off site);

_____ 2. (g) Handling of materials in bulk quantities (equal or greater than 55 gallons or 100 pounds net dry weight transported held in an individual container) that, if released to the environment, would be a pollutant;

_____ 2. (j) Storing or related handling of road oils, dust suppressants,, at a central location;

_____ 2. (k) Application or related handling of road oils, dust suppressants or deicing materials, (does not include use of chloride-based deicing materials applied to roads or parking lots);

_____ 2. (m) Installation, construction, operation, or abandonment of wells, bore holes, or core holes, (this does not include bore holes for the purpose of explosive demolition);

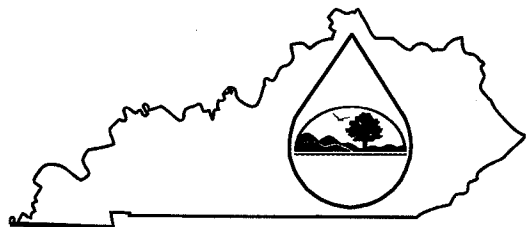
Or, check the following only if there are no qualifying activities

_____ There are no activities for this project as listed in 401 KAR 5:037 Section 2 that require the preparation and implementation of a groundwater protection plan.

KyTC BMP Plan for Project PCN ## - #####

The contractor is responsible for the preparation of a plan that addresses the 401 KAR 5:037 Section 3. (3) Elements of site specific groundwater protection plan:

- (a) General information about this project is covered in the Project information;
- (b) Activities that require a groundwater protection plan have been identified above;
- (c) Practices that will protect groundwater from pollution are addressed in section C. Other control measures.
- (d) Implementation schedule – all practices required to prevent pollution of groundwater are to be in place prior to conducting the activity;
- (e) Training is required as a part of the ground water protection plan. All employees of the contractor, sub-contractor and resident engineer personnel will be trained to understand the nature and requirements of this plan as they pertain to their job function(s). Training will be accomplished within one week of employment and annually thereafter. A record of training will be maintained by the contractor with a copy provide to the resident engineer.
- (f) Areas of the project and groundwater plan activities will be inspected as part of the weekly sediment and erosion control inspections
- (g) Certification (see signature page.)



**Kentucky Pollutant Discharge Elimination System
(KPDES)
Notice of Intent (NOI)
for Storm Water Discharges
Associated with Industrial Activity Under the
KPDES General Permit**

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a KPDES permit issued for storm water discharges associated with industrial activity. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit.

ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM (See Instructions on back)

I. Facility Operator Information

Name:	KYTC District 5	Phone:	5023676411
Address:	977 Phillips Lane	Status of Owner/Operator:	S
City, State, Zip Code:	Louisville, KY 40209		

II. Facility/Site Location Information

Name:	KYTC PN ##-####		
Address:	US 42 & KY 841		
City, State, Zip Code:	Louisville, KY 40059		
County:	Jefferson		
Site Latitude: (degrees/minutes/seconds)	38/18/00 North	Site Longitude: (degrees/minutes/seconds)	85/35/00 West

III. Site Activity Information

MS4 Operator Name:	Louisville/Jefferson County Metropolitan Sewer District					
Receiving Water Body:	Harrods Creek					
Are there existing quantitative data?	Yes <input type="checkbox"/> If Yes, submit with this form. No <input checked="" type="checkbox"/>					
SIC or Designated Activity Code Primary	1611	2nd		3rd		4 th
If this facility is a member of a Group Application, enter Group Application Number:						
If you have other existing KPDES Permits, enter Permit Numbers:						

IV. Additional Information Required FOR CONSTRUCTION ACTIVITIES ONLY

Project Start Date:		Completion Date:	
Estimated Area to be disturbed (in acres):	3		
Is the Storm Water Pollution Prevention Plan in Compliance with State and/or Local Sediment and Erosion Plans?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		

V. Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed or Typed Name:		
Signature:	Date:	

**Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity
To Be Covered Under The KPDES General Permit**

WHO MUST FILE A NOTICE OF INTENT (NOI) FORM

Federal law at 40 CFR Part 122 prohibits point source discharges of stormwater associated with industrial activity to a water body of the Commonwealth of Kentucky without a Kentucky Pollutant Discharge Elimination System (KPDES) permit. The operator of an industrial activity that has such a storm water discharge must submit a NOI to obtain coverage under the KPDES Storm Water General Permit. If you have questions about whether you need a permit under the KPDES Storm Water program, or if you need information as to whether a particular program is administered by the state agency, call the **Storm Water Contact, Industrial Section, Kentucky Division of Water at (502) 564-3410.**

WHERE TO FILE NOI FORM

NOIs must be sent to the following address:

**Section Supervisor
Inventory & Data Management Section
KPDES Branch, Division of Water
Frankfort Office Park
14 Reilly Road
Frankfort, KY 40601**

COMPLETING THE FORM

Type or print legibly in the appropriate areas only. If you have any questions regarding the completion of this form call the **Storm Water Contact, Industrial Section, at (502) 564-3410.**

SECTION I - FACILITY OPERATOR INFORMATION

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same as the name of the facility. The responsible party is the legal entity that controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Enter the appropriate letter to indicate the legal status of the operator of the facility.

F = Federal M = Public (other than federal or state)
S = State P = Private

SECTION II - FACILITY/SITE LOCATION INFORMATION

Enter the facility's or site's official or legal name and complete street address, including city, state, and ZIP code.

SECTION III - SITE ACTIVITY INFORMATION

If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g., municipality name, county name) and the receiving water of the discharge from the MS4. (A MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, borough, county, parish, district, association, or other public body which is designed or used for collecting or conveying storm water.)

If the facility discharges storm water directly to receiving water(s), enter the name of the receiving water.

Indicate whether or not the owner or operator of the facility has existing quantitative data that represent the characteristics and concentration of pollutants in storm water discharges. If data is available submit with this form.

List, in descending order of significance, up to four 4-digit standard industrial classification (SIC) codes that best describe the principal products or services provided at the facility or site identified in Section II of this application.

If the facility listed in Section II has participated in Part 1 of an approved storm water group application and a group number has been assigned, enter the group application number in the space provided.

If there are other KPDES permits presently issued for the facility or site listed in Section II, list the permit numbers.

SECTION IV - ADDITIONAL INFORMATION REQUIRED FOR CONSTRUCTION ACTIVITIES ONLY

Construction activities must complete Section IV in addition of Sections I through III. Only construction activities need to complete Section IV.

Enter the project start date and the estimated completion date for the entire development plan.

Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre).

Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, permits, or storm water management plans.

SECTION V - CERTIFICATION

Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

LETTING JUNE 2007

**KENTUCKY TRANSPORTATION CABINET
COMMUNICATING ALL PROMISES (CAP)**

JEFFERSON COUNTY

5-173.00

(NO CAPS INVOLVED IN PROJECT)

PART II

SPECIFICATIONS AND STANDARD DRAWINGS

SPECIFICATIONS REFERENCE

Any reference in the plans or proposal to the *Standard Specifications for Road and Bridge Construction, Edition of 2000*, and *Standard Drawings, Edition of 2000* are superseded by *Standard Specifications for Road and Bridge Construction, Edition of 2004* and *Standard Drawings, Edition of 2003*.

Special Notes [SN] and Special Provisions [SP] marked with an asterisk * and listed under Part II of the Table of Contents within this proposal can be referenced in the *Standard Specifications for Road and Bridge Construction, Edition of 2004*. Special Notes and Special Provisions not marked with an asterisk will be attached to this proposal.

**Supplemental Specifications to The Standard Specifications
for Road and Bridge Construction, 2004 Edition**
(Effective with the July 27, 2007 Letting)

SUBSECTION: 105.07 COOPERATION WITH UTILITIES. REVISION: In the last paragraph, replace “KRS 367 Sections 1 through 10” with “KRS 367.4901 through 367.4917”
SUBSECTION: 108.01 SUBCONTRACTING OF CONTRACT. REVISION: Replace the second and third sentence of the first paragraph with the following: When the Engineer gives such consent, the Engineer will allow the Contractor to subcontract a portion, but the Contractor must perform with his own organization work amounting to no less than 30 percent of the total Contract cost. The Department will not allow any subcontractor to exceed the percentage to be performed by the Contractor and will require the Contractor to maintain a supervisory role over the entire project.
SUBSECTION: 109.07 PRICE ADJUSTMENT. REVISION: Replace the section with the following: 109.07 PRICE ADJUSTMENTS. Due to the fluctuating costs of petroleum products, the Department will adjust the compensation of specified liquid asphalt items and diesel fuel in contracts when contract quantity thresholds are met. 109.07.01 Liquid Asphalt. The Department will compare the Kentucky Average Price Index (KAPI), for the month that the Contract is let, to the index for the month that the Contractor places the material on the project to determine the percent change. When the original contract quantity for asphalt items is equal to or greater than 3,000 tons and when the average price of the liquid asphalt products increases or decreases more than 5 percent, the Department will adjust the Contractor’s compensation. The KAPI is calculated monthly using the average price, per ton at the terminal, from the active suppliers of liquid asphalt. <u>Adjustable Contract Items:</u> <ul style="list-style-type: none">• Asphalt Curing Seal• Asphalt Material for Prime• Asphalt Base, All Classes• Asphalt Binder• Asphalt Surface, All Classes• Sand Asphalt Surface• Asphalt Open-Graded Surface• Asphalt Seal Coat• Asphalt Mixture for Leveling and Wedging• Drainage Blanket - Type II - Asphalt The Department will determine the price adjustment using the following formulas: <u>When PC is greater than PL</u> Asphalt Price Adjustment = $(Q \times A)/100 \times PL \times [(PC-PL)/PL - 0.05]$ <u>When PC is less than PL</u> Asphalt Price Adjustment = $(Q \times A)/100 \times PL \times [(PC-PL)/PL + 0.05]$ Where: Q = Tons of material or mixture placed each month. A = Percent of material or mixture that is asphalt. PL = KAPI for the month that the Contract is let. PC = KAPI for the month that the Contractor places the material or mixture. The job-mix formula for asphalt base, binder, and surface mixtures determines “A”, which is the percent of asphalt. For recycled mixtures, the Department will determine the adjustment for the new asphalt cement only. The Department will consider materials for prime and seal as 100 percent asphalt.

**Supplemental Specifications to The Standard Specifications
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Revision
Continued

109.07.02 Fuel. The Department will adjust the Contractor's compensation when the average price of diesel fuel increases or decreases more than 5 percent and the original Contract quantity for the item on which the fuel is consumed is equal to or greater than the threshold quantities listed in the following table.

<u>Item</u>	<u>Threshold Quantity</u>	<u>Fuel/Work</u>
Roadway Excavation	10,000 cubic yards	0.25
Embankment-in-Place	10,000 cubic yards	0.25
Borrow Excavation	10,000 cubic yards	0.25
DGA Base or Crushed Stone Base	5,000 tons	0.52
Stabilized Aggregate Base	5,000 tons	0.52
Drainage Blanket, Cement Treated or Untreated	5,000 tons	0.52
Drainage Blanket, Asphalt Treated	5,000 tons	3.00
Crushed Sandstone Base (Cement Treated)	5,000 tons	0.52
Hot-Mixed Asphalt Mixtures for Pavements or Shoulders	3,000 tons ⁽¹⁾	3.00
PCC Pavement, Base, or Shoulders	2,000 square yards ⁽²⁾	0.14

⁽¹⁾Total of all hot mixed asphalt Contract items.

⁽²⁾Total of all JPC pavement, JPC shoulder, and PCC base, Contract items.

The Department will determine the price adjustment using the following formulas:

When PC is greater than PL

$$\text{Fuel Price Adjustment} = Q \times F \times PL \times [(PC-PL)/PL - 0.05]$$

When PC is less than PL

$$\text{Fuel Price Adjustment} = Q \times F \times PL \times [(PC-PL)/PL + 0.05]$$

Where:

Q = Quantity for applicable item placed or performed that month.

F = The fuel to work unit ratio for each applicable item.

PL = Average reseller price of diesel fuel, excluding taxes, discounts, and superfund line items, in the Kentucky region for the month that the Contract is let.

PC = Average reseller price of diesel fuel, excluding taxes, discounts, and superfund line items, in the Kentucky region for the month that the Contractor uses the fuel on the project.

109.07.03 Payments and Deductions. When thresholds are met, the Department will adjust the Contractor's compensation for each eligible pay item, paid or deducted, monthly.

If later price decreases indicate that the Department made an overpayment, the Department will withhold the overpayment from succeeding pay estimates on the project, or the Contractor shall immediately refund the over payment to the Department.

When the Contractor places materials during any month after the month that the Contract time (including all approved time extensions) expires, the Department will use the average price for the month that the Contractor places the material or the average price for the last month of the Contract time; whichever is least.

The Department will not grant a time extension for any overrun in the Contract amount due to payments made according to this section. The Department will not make any additional compensation due to adjustments made according to this section.

The Department will adjust the Contractor's compensation on the following months pay estimate and on the final pay estimate. The Department will make the final adjustment of the Contractor's compensation on the final estimate for the project.

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<p>SUBSECTION: 110.01 MOBILIZATION. REVISION: Replace the third paragraph with the following:</p>	<p>Do not bid an amount for Mobilization that exceeds 5 percent of the sum of the total amounts bid for all items in the Bid Proposal, excluding Mobilization, Demobilization, and contingent amounts established for adjustments and incentives. The Department will automatically adjust any bids in excess of this amount to 5 percent for bid comparisons. The Department will base the award on the maximum allowable bid of 5 percent. If any errors in unit bid prices for other Contract items in a Contractor's Bid Proposal are discovered after bid opening and such errors reduce the total amount bid for all other items, excluding Mobilization, Demobilization, and contingent amounts established for adjustments and incentives, so that the percent bid for Mobilization is larger than 5 percent, the Department will adjust the amount bid for Mobilization to 5 percent of the sum of the corrected total bid amounts.</p>						
<p>SUBSECTION: 110.02 DEMOBILIZATION. REVISION: Replace the first sentence of the third paragraph with the following:</p>	<p>Do not bid an amount for Demobilization that is less than 1.5 percent of the sum of the total amounts bid for all other items in the Bid Proposal, excluding Mobilization, Demobilization, and contingent amounts established for adjustments and incentives.</p>						
<p>SUBSECTION: 206.03.03 Compaction. REVISION: Replace "KM 64-412" with "KM 64-002"</p>							
<p>SUBSECTION: 206.04.01 Embankment-in-Place. REVISION: Replace the first sentence of the sixth paragraph with the following:</p>	<p>When payment is made for Embankment-in-Place, the Department will make payment for all embankment constructed on the project, including roadway embankment, refill in cuts, and embankment placed in embankment benches.</p>						
<p>SUBSECTION: 212.03.03 Permanent Seeding and Protection. PART: Delete Part C) and replace Parts A) and B) with the following: REVISION: A) Seed Mixtures for Permanent Seeding.</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Seed Mix Type I:</td> <td style="padding: 5px;"> 30% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 20% Creeping Red Fescue (<i>Festuca rubra</i>) 35% Hard Fescue (<i>Festuca (Festuca longifolia)</i>) 10% Ryegrass, Perennial (<i>Lolium perenne</i>) 5% White Dutch Clover (<i>Trifolium repens</i>) </td> </tr> <tr> <td style="padding: 5px;">Seed Mix Type II:</td> <td style="padding: 5px;"> 55% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 15% Ryegrass, Perennial (<i>Lolium perenne</i>) 15% (based on pure live seed, PLS) Little Bluestem (<i>Schizachyrium scoparium</i>) 15% Crown Vetch (<i>coronilla varia</i>) </td> </tr> <tr> <td style="padding: 5px;">Seed Mix Type III:</td> <td style="padding: 5px;"> 40% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 15% Perennial Ryegrass <i>Lolium perenne</i>) 20% Sericea Lespedeza (<i>Lespedeza cuneata</i>) 25% (based on pure live seed, PLS) Little Bluestem (<i>Schizachyrium scoparium</i>) </td> </tr> </table> <p style="margin-left: 40px;">1) Permanent Seeding on Slopes 3:1 or Less. Apply seed mix Type I at a minimum application rate of 100 pounds per acre.</p> <p style="margin-left: 40px;">2) Permanent Seeding on Slopes Greater than 3:1 in Highway Districts 4, 5, 6, and 7. Apply seed mix Type II at a minimum application rate of 100 pounds per acre plus a nurse crop of either Cereal Rye or German Foxtail-Millet based on the time of year. During the months of June through August, apply 10 pounds of German Foxtail-Millet (<i>Setaria italica</i>). During the months of September through May, apply 56 pounds of Cereal Rye (<i>Secale cereale</i>). If adjacent to golf courses replace the crown vetch with Kentucky 31 Tall Fescue</p>	Seed Mix Type I:	30% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 20% Creeping Red Fescue (<i>Festuca rubra</i>) 35% Hard Fescue (<i>Festuca (Festuca longifolia)</i>) 10% Ryegrass, Perennial (<i>Lolium perenne</i>) 5% White Dutch Clover (<i>Trifolium repens</i>)	Seed Mix Type II:	55% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 15% Ryegrass, Perennial (<i>Lolium perenne</i>) 15% (based on pure live seed, PLS) Little Bluestem (<i>Schizachyrium scoparium</i>) 15% Crown Vetch (<i>coronilla varia</i>)	Seed Mix Type III:	40% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 15% Perennial Ryegrass <i>Lolium perenne</i>) 20% Sericea Lespedeza (<i>Lespedeza cuneata</i>) 25% (based on pure live seed, PLS) Little Bluestem (<i>Schizachyrium scoparium</i>)
Seed Mix Type I:	30% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 20% Creeping Red Fescue (<i>Festuca rubra</i>) 35% Hard Fescue (<i>Festuca (Festuca longifolia)</i>) 10% Ryegrass, Perennial (<i>Lolium perenne</i>) 5% White Dutch Clover (<i>Trifolium repens</i>)						
Seed Mix Type II:	55% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 15% Ryegrass, Perennial (<i>Lolium perenne</i>) 15% (based on pure live seed, PLS) Little Bluestem (<i>Schizachyrium scoparium</i>) 15% Crown Vetch (<i>coronilla varia</i>)						
Seed Mix Type III:	40% Kentucky 31 Tall Fescue (<i>Festuca arundinacea</i>) 15% Perennial Ryegrass <i>Lolium perenne</i>) 20% Sericea Lespedeza (<i>Lespedeza cuneata</i>) 25% (based on pure live seed, PLS) Little Bluestem (<i>Schizachyrium scoparium</i>)						

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revision continued	<p>3) Permanent Seeding on Slopes Greater than 3:1 in Highway Districts 1, 2, 3, 8, 9, 10, 11, and 12. Apply seed mix Type III at a minimum application rate of 100 pounds per acre plus a nurse crop of either Cereal Rye or German Foxtail-Millet based on the time of year. During the months of June through August, apply 10 pounds of German Foxtail-Millet (<i>Setaria italica</i>). During the months of September through May, apply 56 pounds of Cereal Rye (<i>Secale cereale</i>). If adjacent to crop land or golf course replace the <i>Sericea Lespedeza</i> with Kentucky 31 Tall Fescue.</p> <p>B) Procedures for Permanent Seeding. Include a seeding plan in the Best Management Practices plan (BMP) according to Section 213. Prepare a seedbed and incorporate fertilizer and agricultural limestone as needed. Do not apply dry agricultural Limestone when it may generate a traffic hazard. Remove all rock and dirt clods over 4 inches in diameter from the surface of the seedbed. Unless the Engineer directs otherwise, track all slopes 3:1 or greater. Ensure that tracking is performed up and down and not across. Native Grass seed should be calculated figuring seed on a pure live seed basis (PLS), using the least amount of inert matter available. Seed and mulch to produce a uniform vegetation cover using the seeding rates as indicated to each application. Mulch with clean, weed free straw. Place straw to an approximate 2-inch loose depth (2 tons per acre) and anchor it into the soil by mechanically crimping it into the soil surface or applying tackifier to provide a protective cover. For the periods of March 1 through May 15 and from September 1 through November 1, the Department will allow the option of using hydromulch at minimum rate of 1,500 pounds per acre in place of straw with tackifier. Regardless of materials used, ensure the protective cover holds until seeding is acceptably established according to part G) of this subsection.</p>
SUBSECTION: REVISION:	213.03.01 Best Management Practices (BMP). Replace the second and third sentence of the first paragraph with the following: Include erosion control for all off right of way work performed under a Department acquired permit. Ensure that the BMP provides storage for 3,600 cubic feet of water per surface acre disturbed.
SUBSECTION: REVISION:	213.03.02 Progress Requirements. Add the following after the first sentence of the third paragraph: Seed and mulch areas at final grade within 14 days. Temporary mulch areas not at final grade if work stops for longer than 21 days. Temporary mulch soil stock piles within 14 days of the last construction activity in that area.
SUBSECTION: REVISION:	213.03.03 Inspection and Maintenance Replace both "0.1-inch" references with "0.5-inch". Add the following sentence to the end of the second paragraph: Initiate corrective action within 24 hours of any reported deficiency.
SUBSECTION: PART: REVISION:	213.03.05 Temporary Control Measures. B) Silt Checks. B) Silt Checks. Use one of the following types: 1) Silt Check Type II - Crushed stone such as cyclopean stone riprap, quarry run stone, or other size material approved by the Engineer, dumped in place and shaped to the configuration required. 2) Silt Check Type III - Blasted or broken rock dumped in place and shaped to the configuration required. Remove and properly dispose of sediment deposited at silt checks as necessary. When no longer needed, remove the silt checks and dispose of surplus materials as excavated materials according to Section 204. Seed and protect the entire area disturbed, as directed. Do not leave silt checks in place after completion of the project unless allowed by the Engineer or specified in the Plans.

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<p>SUBSECTION: 213.03.05 Temporary Control Measures. PART: F) Temporary Seeding and Protection. REVISION: Replace the first sentence with the following:</p>	<p>Apply seed mix Type I at a minimum application rate of 100 pounds per acre plus a nurse crop of either Cereal Rye or German Foxtail-Millet based on the time of year. During the months of June through August, apply 10 pounds of German Foxtail-Millet (<i>Setaria italica</i>). During the months of September through May, apply 56 pounds of Cereal Rye (<i>Secale cereale</i>). Obtain the Engineer's approval for the seed before use.</p>
<p>SUBSECTION: 213.03.05 Temporary Control Measures. PART: G) Temporary Mulch. REVISION: Replace the last sentence with the following:</p>	<p>Place temporary mulch to an approximate 2-inch loose depth (2 tons per acre) and apply tackifier.</p>
<p>SUBSECTION: 213.04.15 Temporary Silt Ditch. REVISION: Replace with the following:</p>	<p>The Department will measure the quantity in linear feet.</p>
<p>SUBSECTION: 213.04 MEASUREMENT. REVISION: Add the following Subsection:</p>	<p>213.04.24 Clean Temporary Silt Ditch. The Department will measure the quantity in linear feet along the ditch line.</p>
<p>SUBSECTION: 213.05 PAYMENT. REVISION: Add the following lines:</p>	<p>20594 Temporary Silt Ditch Linear Foot 20601 Clean Temporary Silt Ditch Linear Foot</p>
<p>SUBSECTION: 303.03.01 Mixture PART: C) Cement Treated Mixture. REVISION: Delete the "For asphalt pavements" from the second paragraph.</p>	
<p>SUBSECTION: 303.03.01 Mixture PART: C) Cement Treated Mixture. REVISION: Delete requirement "2".</p>	
<p>SUBSECTION: 401.02.01 All Asphalt Mixing Plants. REVISION: Replace the third paragraph and numbers 1) and 2) with the following:</p>	<p>When plants are in operation, the Department will require one computer on the site of operations for the purpose of recording and submitting test data. Ensure Microsoft Office 2003 Professional, full installation, is installed on the computer and used for data submittal.</p>
<p>SUBSECTION: 402.03.02 Acceptance. PART: D) Testing Responsibilities. NUMBER: 4) Density. REVISION: Replace the first sentence of the third paragraph with the following:</p>	<p>For surface mixtures placed on driving lanes and ramps, furnish 2 cores per subplot to the nearest laboratory facility (Contractor or Department lab) for density determination by the Engineer.</p>
<p>SUBSECTION: 402.03.02 Acceptance. PART: H) Unsatisfactory Work. NUMBER: 1) Based on Lab Data. REVISION: Replace the "AASHTO MP2" references in the second paragraph with "AASHTO M 323".</p>	
<p>SUBSECTION: 402.04 MEASUREMENT. REVISION: Replace the last sentence with the following:</p>	<p>The Department will not measure construction of rolled rumble strips or pavement wedge texturing for payment and will consider them incidental to the asphalt mixture.</p>

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SUBSECTION:	402.04.01 Weight.												
REVISION:	Replace first sentence of the second paragraph with the following: The Department will determine the bulk, oven-dry specific gravity for the fine and coarse aggregates according to KM64-605 and AASHTO T 85, respectively.												
SUBSECTION:	402.04.02 Thickness on New Construction.												
REVISION:	Delete the third paragraph and add the following at the end of the subsection: The Department will not measure initial thickness check coring or coring of corrective work for payment and will consider it incidental to the asphalt mixture.												
SUBSECTION:	402.05.02												
PARTS:	Lot Pay Adjustment Schedule, Compaction Option A, Base and Binder Mixtures Lot Pay Adjustment Schedule, Compaction Option A, Surface Mixtures Lot Pay Adjustment Schedule, Compaction Option B Mixtures												
REVISION:	Replace the VMA table with the following:												
<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th colspan="2">VMA</th> </tr> <tr> <th>Pay Value</th> <th>Deviation From Minimum</th> </tr> </thead> <tbody> <tr> <td align="center">1.00</td> <td align="center">≤ 0.5 below min. VMA</td> </tr> <tr> <td align="center">0.95</td> <td align="center">0.6-1.0 below min.</td> </tr> <tr> <td align="center">0.90⁽²⁾</td> <td align="center">1.1-1.5 below min.</td> </tr> <tr> <td align="center">⁽¹⁾/₍₂₎</td> <td align="center">> 1.5 below min.</td> </tr> </tbody> </table>		VMA		Pay Value	Deviation From Minimum	1.00	≤ 0.5 below min. VMA	0.95	0.6-1.0 below min.	0.90 ⁽²⁾	1.1-1.5 below min.	⁽¹⁾ / ₍₂₎	> 1.5 below min.
VMA													
Pay Value	Deviation From Minimum												
1.00	≤ 0.5 below min. VMA												
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0.90 ⁽²⁾	1.1-1.5 below min.												
⁽¹⁾ / ₍₂₎	> 1.5 below min.												
SUBSECTION:	403.03.03 Preparation of Mixture.												
PART:	A) Mixture Composition.												
REVISION:	Replace the "AASHTO MP2" reference in the first paragraph with "AASHTO M 323". From the aggregate requirements list, delete 3) Type C.												
SUBSECTION:	403.03.03 Preparation of Mixture.												
PART:	C) Mix Design Criteria.												
REVISION:	Replace the "AASHTO MP2" references with "AASHTO M 323". Replace the "AASHTO PP28" references in the second paragraph with "AASHTO R 35".												
SUBSECTION:	403.03.03 Preparation of Mixture.												
PART:	C) Mix Design Criteria.												
NUMBER	1) Preliminary Mix Design.												
REVISION:	Add the following footnote to the table and associate it with the ESAL's field "<0.3": * For CL1 ASPH SURF 0.38D PG64-22 only.												
SUBSECTION:	403.03.06 Thickness Tolerances.												
PART:	B) New Construction.												
REVISION:	Replace the first paragraph with the following: Under the Engineer's supervision, perform coring for thickness checks according to KM 64-420, as soon as practical after completion of all, or a major portion, of the asphalt base. The Engineer will measure the cores. Fill all core holes either with compacted asphalt mixture or non-shrink grout. Complete all remedial overlay work before placing the final course.												

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SUBSECTION: 403.03.08 Rumble Strips.
REVISION: Replace with the following:

403.03.08 Shoulder Rumble Strips and Pavement Wedge Texturing.

A) Shoulder Rumble Strips.

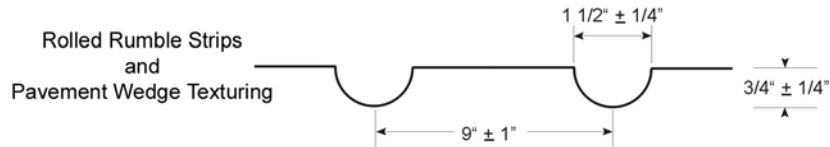
1) Interstates and Parkways. Construct sawed rumble strips on all mainline shoulders to the dimensions shown below. Do not place rumble strips on ramps.

2) Other Roads. Construct rolled rumble strips on shoulders of facilities with posted speed limits greater than 45 MPH. Unless specified in the plans or directed by the Engineer, do not construct rumble strips on facilities with posted speed limits of 45 MPH or less.

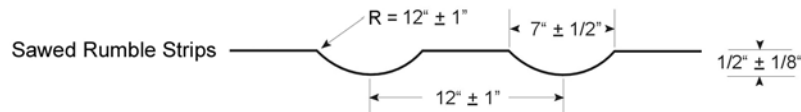
Construct rolled rumble strips on mainline shoulders to the dimensions shown below. On shoulders less than 3 feet wide, shorten the width and distance of the strips as the Engineer directs. Time the rolling operation so indentations are at the specified size and depth without causing unacceptable displacement of the asphalt mat. Correct unacceptable rolled rumble strips by sawing.

B) Pavement Wedge Texturing. Perform texturing on all pavement wedges constructed monolithically with the mainline or constructed using a surface mixture. When furnishing Asphalt Mixture for Pavement Wedge, binder, or a base mixture for the wedge, the Department will not require texturing.

Texture to the dimensions shown below. On wedges less than 3 feet, shorten the length and distance of the texturing as the Engineer directs. Time the rolling operation so indentations are at the specified size and depth without causing unacceptable displacement of the asphalt mat.



Place one foot out from the mainline pavement and to a width of 2 feet.



Place one foot out from the mainline pavement and to a width of 16 inches.

SUBSECTION: 403.04.03 Asphalt Mixtures.
REVISION: Replace the second sentence with the following:

The Department will not measure rolled rumble strips or pavement wedge texturing for payment and will consider them incidental to this bid item.

SUBSECTION: 403.04.07 Sawed Rumble Strips.
REVISION: Add the following subsection:

403.04.07 Sawed Rumble Strips. The Department will measure the quantity in linear feet. When rolled in rumble strips are specified, the Department will not measure sawed rumble strips for payment and will consider them incidental to the asphalt mixture.

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SUBSECTION:	403.05 PAYMENT						
REVISION:	Add the following bid item:						
	<table border="0"> <thead> <tr> <th align="left"><u>Code</u></th> <th align="left"><u>Pay Item</u></th> <th align="left"><u>Pay Unit</u></th> </tr> </thead> <tbody> <tr> <td>20362</td> <td>Shoulder Rumble Strips – Sawed</td> <td>Linear Foot</td> </tr> </tbody> </table>	<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>	20362	Shoulder Rumble Strips – Sawed	Linear Foot
<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>					
20362	Shoulder Rumble Strips – Sawed	Linear Foot					
SUBSECTION:	501.03.20 Opening to Public Traffic.						
REVISION:	Delete the last sentence of the first paragraph.						
SUBSECTION:	501.03.21 Tolerance in Pavement Thickness.						
REVISION:	Add the following: Core the pavement as the Engineer directs.						
SUBSECTION:	501.04.06 Thickness.						
REVISION:	Add the following: The Department will not measure coring for payment and will consider it incidental to the concrete pay items.						
SUBSECTION:	502.03 CONSTRUCTION.						
PART:	C) Curing and Protecting Pavement.						
NUMBER:	3)						
REVISION:	Replace the last sentence with the following: The Department will allow permanent removal of the cover when the concrete attains the required opening strength of 3,000 psi.						
SUBSECTION:	502.03 CONSTRUCTION.						
PART:	D) Strength Testing and Opening to Traffic.						
NUMBER:	2) Testing.						
REVISION:	Replace the second paragraph with the following: When the average compressive strength is 3,000 psi, the Department will allow the pavement to be opened to traffic and will test the remaining sets of cylinders at the required age. When the average compressive strength is less than 3,000 psi at the required age, do not open the pavement to traffic until the pavement has been in place for 7 days. The Engineer may accept the pavement based on additional testing.						
SUBSECTION:	503.03.09 Ride Quality.						
REVISION:	Replace parts 5) and 6) with the following: 5) Perform corrective work to achieve the required IRI by regrinding the entire width of the traffic lane at areas having a high IRI. The Engineer may exclude pavement areas where grinding alone will not correct deficiency. 6) The Department will create a strip chart when the test results show that the IRI is greater than 60 or upon request for lower IRI values.						
SUBSECTION:	601.03.02 Concrete Producer Responsibilities.						
REVISION:	Replace the first sentence with the following: Use a concrete producer from the List of Approved Materials when the quantity of concrete delivered to the project in a plastic condition is 250 cubic yards or more. Ensure that the concrete producer complies with the following requirements:						

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<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: C) Quality Control. REVISION: Replace the first paragraph with the following:</p>	<p>Take full responsibility for the batch weight calculations and quality control of concrete mixtures at the plant. Ensure that the Level II concrete technician is present when work is in progress and is responsible for inspecting trucks, batch weight calculations, monitoring batching, making mixture adjustments, reviewing the slump, air content and unit weight tests, and monitoring the concrete temperature, all to provide concrete to the project conforming to specifications. A Level I concrete technician is responsible for testing production material for slump, entrained air, unit weight and temperature of the mixture. Ensure the technician performs all sampling and testing according to the appropriate Kentucky Methods.</p> <p>Delete the third paragraph.</p>
<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: F) Records. REVISION: Retain all concrete technician records, test results and batch tickets pertaining to concrete produced for a Department project for at least 3 years after formal acceptance of the project. Make all records available to the Engineer and the Contractor on the project for review upon request.</p>	
<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: G) Mix Designs. REVISION: Replace the last sentence of the first paragraph with the following:</p>	<p>Before producing any concrete for the project, submit a proposed mixture design to the Engineer and obtain the District Materials engineer's or the Central Office Material's approval. Submit the mix design electronically using Microsoft Office 2003 Professional, full installation, and the Concrete Mix Design Spreadsheet located on the Division of Materials Website.</p>
<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: G) Mix Designs. NUMBER: 1) New Mixture Designs. REVISION: Replace the first sentence with the following:</p>	<p>Base the proposed mix design on standard Department methods unless the District Materials Engineer, or Central Office Materials approves otherwise.</p>
<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: G) Mix Designs. NUMBER: 1) New Mixture Designs. LETTER: b)</p>	
<p>REVISION: Replace the second sentence with the following:</p>	<p>The District Materials Engineer or Central Office Materials will provide an average value of the specific gravity aggregate absorption.</p>
<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: G) Mix Designs. NUMBER: 1) New Mixture Designs. LETTER: g) REVISION: Replace the fourth and fifth sentence with the following:</p>	<p>Central Office Materials will observe all phases of the trial batches. Have the producer submit a report containing mix proportions and test results for slump, air content, water/cement ratio, unit weight, and compressive strength for each trial batch to the Engineer for Central Office Materials review and approval.</p>

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<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: G) Mix Designs. NUMBER: 2) Approval. REVISION: Replace the first sentence with the following:</p> <p>The District Materials Engineer or Central Office Materials will base approval of the mixture design on the following criteria:</p>
<p>SUBSECTION: 601.03.02 Concrete Producer Responsibilities. PART: G) Mix Designs. NUMBER: 3) Changes in Approved Mix Designs. REVISION: Replace the first sentence with the following:</p> <p>Do not change the source of supply of the mixture ingredients without the District Materials Engineer's or Central Office Materials written permission.</p> <p>Replace the third sentence with the following:</p> <p>Upon the District Materials Engineer's or Central Office Materials written approval, the Department will allow the use of aggregate from the new source.</p>
<p>SUBSECTION: 601.03.03 Proportioning and Requirements. PART: A) Concrete. TABLE: INGREDIENT PROPORTIONS AND REQUIREMENTS FOR VARIOUS CLASSES OF CONCRETE REVISION: Under Class of Concrete replace "AAA⁽⁹⁾" with "AAA⁽⁸⁾"</p>
<p>SUBSECTION: 601.03.03 Proportioning and Requirements. PART: A) Concrete. FOOTNOTE: (6) REVISION: Add the following after the first sentence of the first paragraph:</p> <p>For products with voids, the slump may be increased to 7 inches.</p> <p>Replace the "0.3" requirement for Spring and Fall mix designs with "0.37".</p>
<p>SUBSECTION: 601.03.03 Proportioning and Requirements. PART: A) Concrete. FOOTNOTE: (7) REVISION: Replace with the following:</p> <p>The precast fabricator may increase the slump of Class A concrete to a maximum of 7 inches provided the fabricator uses a high range water reducer (Type F and G) and maximum water/cement ratio of 0.46.</p>
<p>SUBSECTION: 601.03.03 Proportioning and Requirements. PART: E) Measuring. NUMBER: 3) Water. REVISION: Delete the last sentence of the second paragraph.</p>

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<p>SUBSECTION: 601.03.03 Proportioning and Requirements. PART: E) Measuring. NUMBER: 4) Measuring Admixtures. REVISION: Replace with the following:</p>	<p>4) Measuring Admixtures. Introduce liquid admixtures into the concrete batch along with, or as part of, the mixing water. Keep air-entraining admixtures completely separate from all other admixtures until introduction into the batch. Maintain and equip dispensing equipment to ensure no chlorides are introduced into any Department mix.</p> <p>Use approved dispensing equipment with a meter, gauge, or scale that can accurately be pre-set for the needed amount of admixture and can consistently deliver quantities of admixture to successive batches at any setting with satisfactory accuracy. The dispensing equipment must be visible to the batch operator if the actual dispensed amounts are not recorded on the computer batch ticket. Ensure admixture dispensers are inspected, calibrated and certified every 6 months.</p> <p>The Department may allow admixtures to be added, to the truck, at the project site provided the Engineer's approval is obtained first.</p>
<p>SUBSECTION: 601.03.04 Classes and Primary Uses. REVISION: Add the following part:</p>	<p>R) Dry Cast. Precast units.</p>
<p>SUBSECTION: 601.03.05 Admixtures. REVISION: Replace the last sentence of the fourth paragraph with the following:</p>	<p>Store admixtures where the liquid temperatures can be maintained between 32 and 110 °F.</p>
<p>SUBSECTION: 601.03.09 Placing Concrete. PART: D) Weather Limitations and Protection. REVISION: Delete the last sentence of paragraph two.</p>	
<p>SUBSECTION: 605.03 CONSTRUCTION. REVISION: Insert the following sentence after the first sentence:</p>	<p>Ensure all non-composite box beam concrete contains an approved corrosion inhibitor from the List of Approved Materials.</p>
<p>SUBSECTION: 605.03.03 Casting. REVISION: Delete the first sentence in the first paragraph.</p>	<p>Add the following after the first sentence of the third paragraph:</p> <p>Do not vibrate Self-Consolidating Concrete (SCC).</p>
<p>SUBSECTION: 605.03.04 Tack welding. REVISION: Replace the first sentence with the following:</p>	<p>When tack welding steel reinforcement, use ASTM A 706 steel and conform to the following conditions.</p>
<p>SUBSECTION: 605.03.04 Tack Welding. NUMBER: 3) REVISION: Replace the first sentence with the following:</p>	<p>Tack weld only at intersections of bars except do not tack weld in any bend or within 2 bar diameters of a bend.</p>
<p>SUBSECTION: 605.03.04 Tack Welding. NUMBER: 5) REVISION: Replace the last sentence with the following:</p>	<p>Each sample must meet the minimum requirement for elongation, ductility, tensile and yield strength of the bar stock.</p>

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SUBSECTION:	605.03.04 Tack Welding.
NUMBER:	6)
REVISION:	Delete the last sentence.
SUBSECTION:	605.03.04 Tack Welding.
REVISION:	Change footnote "(4) (d)" to "(5)"
SUBSECTION:	605.03.07 Removal of Forms and Surface Finish.
REVISION:	Add the following sentence before the last sentence of the paragraph: Finish dry cast products according to the Precast/Prestressed Concrete Manual.
SUBSECTION:	611.02.01 Concrete.
REVISION:	Replace with the following: Conform to Subsections 601.02 and 601.03 and the Precast/Prestress Concrete Manual.
SUBSECTION:	611.03.02 Precast Unit Construction.
REVISION:	Replace "AASHTO C 1433" with "ASTM C 1433"
SUBSECTION:	611.03.02 Precast Unit Construction.
NUMBER:	2)
REVISION:	Replace with the paragraph with the following: Mark all box culverts sections with the following information on the inside top of each section with letters no less than 2 inches high: <ul style="list-style-type: none"> a) Span, rise, maximum and minimum design earth cover, and KY Table 3. b) Date of manufacture. c) Name and trademark of the manufacturer. For entrance and exit box sections, indent the required information. Mark interior sections by indenting or with waterproof paint.
SUBSECTION:	701.02.05 Backfill Materials.
PART:	A) Granular Backfill.
NUMBER:	1)
REVISION:	Remove "A2" from the list of acceptable materials.
SUBSECTION:	701.03.03 Pipe Bedding.
REVISION:	Replace with the following: 701.03.03 Pipe Bedding. A) Reinforced Concrete Pipe. Construct bedding according to the Standard Drawings and this section. <ul style="list-style-type: none"> 1) Type 1 Installation. When working on a rock foundation, place bedding to a depth of 6 inches or equal to $B_c/12$, the pipe diameter in inches divided by 12, whichever is greater. For all other foundations, place a minimum of 4 inches of bedding. Shape the bedding to conform to the invert shape throughout the entire width and length of the proposed structure. Compact the bedding, but leave the center third of the pipe diameter ($B_c/3$) uncompacted. Place and compact additional bedding material in lifts 6 inches or less to an elevation of 0.30 the culvert diameter. 2) Type 4 Installation. When working on a rock foundation, place bedding to a depth of 6 inches or equal to $B_c/12$, the pipe diameter in inches divided by 12, whichever is greater. For all other foundations, place a minimum of 4 inches of bedding. B) Corrugated Metal, Thermoplastic, and Structural Plate Pipe. Place and compact bedding to provide 4 inches of bedding below the outside invert of the pipe after shaping. Shape the bedding to conform to the invert shape throughout the entire width and length of the proposed structure. Place and compact additional bedding material in lifts 6 inches or less to an elevation of 0.30 the culvert diameter.

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<p>SUBSECTION: 701.03.06 Initial Backfill. PART: A) Reinforced Concrete REVISION: Replace with the following:</p> <p>A) Reinforced Concrete Pipe.</p> <p>1) Type 1 Installation. When the top of the pipe is not within one pipe diameter of the subgrade, backfill with granular backfill, additional bedding material, or flowable fill from the top of the bedding to an elevation equal to 1/2 the pipe diameter, and either granular backfill, flowable fill, or embankment material in 6-inch lifts to an elevation of one-foot above the pipe.</p> <p>2) Type 4 Installation. Backfill from the top of the bedding with granular backfill, flowable fill, or embankment material in 6-inch lifts to an elevation of one-foot above the pipe. The Department will allow Type 4 installations for median drains and pipe installations located 35 feet or more from the edge of shoulder, back of curb, or any paved surface.</p>
<p>SUBSECTION: 701.05 PAYMENT. REVISION: Replace bid item “2599 Fabric-Geotextile, Type IV Square Yard” with “21433ES214 Fabric-Geotextile, Type IV for Pipe Square Yard⁽²⁾”</p> <p>Replace foot note “** The unit bid price is \$2.00 per square yard for Geotextile Fabric, Type III” with “⁽²⁾The unit price is \$2.00 per square yard for Fabric-Geotextile, Type IV for Pipe”</p>
<p>SUBSECTION: 710.02.15 Plastic Adjusting Rings. REVISION: Replace this section with:</p> <p>710.02.15 Plastic or Rubber Adjusting Rings. Provide plastic or rubber adjusting rings that are on the Department’s List of Approved Materials.</p>
<p>SUBSECTION: 710.03.03 Adjusted Small Drainage Structures. REVISION: Replace the last sentence of the first paragraph:</p> <p>For plastic or rubber adjusting rings, install and seal according to the manufacturer’s recommendations.</p>
<p>SUBSECTION: 711.02 MATERIALS. REVISION: Replace with the following:</p> <p>Conform to the Contract requirements.</p>
<p>SUBSECTION: 713.03 CONSTRUCTION. REVISION: Add the following after the third paragraph:</p> <p>Offset longitudinal lines at least 2 inches from longitudinal pavement construction joints. Offset longitudinal lane lines on multi-lane highways 2 inches towards the median.</p>
<p>SUBSECTION: 714.03.06 Proving Period for Durable Markings. PART: B) Failure. REVISION: Replace the first sentence with the following:</p> <p>During the proving period, the Department will consider markings defective when the retroreflectivity falls below the minimum required or the material fails to meet the other requirements of A) above. Additionally, when more than 10 percent of any one-mile section or individual gore area is defective, the Department will consider the entire section defective.</p>
<p>SUBSECTION: 716.03.08 Testing. REVISION: Replace “10 megohms” with “100 megohms”</p>
<p>SUBSECTION: 721.03 CONSTRUCTION. REVISION: Replace the third paragraph with the following:</p> <p>Install fence 18 inches inside the right-of-way line or in other locations specifically indicated.</p>
<p>SUBSECTION: 723.03 CONSTRUCTION. REVISION: Replace the first sentence of the fourth paragraph with the following:</p> <p>Set right-of-way markers within 12 inches of the right-of-way line.</p>

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SUBSECTION:	724.02.01 Plants.
REVISION:	Replace the reference “American Association of Nurserymen” with “American Nursery and Landscape Association”.
SUBSECTION:	801.01 REQUIREMENTS.
REVISION:	Add the following sentence after the third sentence of the first paragraph: Mills must request and be approved by the Department to supply cement with an SO ₃ content above the value in Table 1 of ASTM C 150.
SUBSECTION:	804.01.03 Conglomerate Sand.
REVISION:	Replace second sentence of the paragraph with the following: Conglomerate sand may include some material which has been produced by crushing larger pieces of the parent material.
SUBSECTION:	804.02 Approval.
REVISION:	Replace first sentence of the second paragraph with the following: The Department will consider a source for inclusion on the Aggregate Source List when the aggregate producer complies with KM 64-608 and provides the following:
SUBSECTION:	804.03 Concrete.
REVISION:	Second sentence in first paragraph should be a separate paragraph immediately following the first and should read as follows: Provide natural, crushed, or conglomerate sand. The Department will allow any combination of natural, crushed, or conglomerate sand when the combination is achieved in the concrete plant weigh hopper. The Engineer may allow other sands. Use natural or conglomerate sands as fine aggregates in concrete intended as a wearing surface for traffic. Conform to the following:
SUBSECTION:	804.04.03 Polish-Resistant Aggregate.
REVISION:	Add the following paragraph: Provide a signed certification from the aggregate producer for the manufactured polish-resistant fine aggregate stating that the aggregate is supplied from the approved parent material as found on the Department’s List of Approved Materials, Polish-Resistant Aggregate Source List and Guidelines on the Division of Materials’ webpage.
SUBSECTION:	804.04.04 Requirements for Combined Aggregates.
PART:	D) Absorption.
REVISION:	Delete the first sentence and replace the second sentence with the following: Provide total combined fine aggregates having a water absorption of no more than 4.0 percent.
SUBSECTION:	804.11 Sampling and Testing.
REVISION:	For Absorption (Fine Aggregate), replace method “AASHTO T 84” with “KM 64-605”
SUBSECTION:	805.02 Approval.
REVISION:	Replace first sentence of the second paragraph with the following: The Department will consider a source for inclusion on the Aggregate Source List when the aggregate producer complies with KM 64-608 and provides the following:

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SUBSECTION:	805.04.01 JPC Base, JPC Pavement, JPC Shoulders, and Concrete for Bridge Decks.
REVISION:	Replace the subsection heading and first sentence with the following: 805.04.01 JPC Base, JPC Pavement, JPC Shoulders, Concrete for Bridge Decks, and Precast Products. Add the following paragraph: Provide a signed certification from the aggregate producer for the approved freeze-thaw coarse aggregate stating that the aggregate is supplied from the approved parent material as found on the Department's List of Approved Materials and Concrete Aggregate Restriction List.
SUBSECTION:	805.04.01 JPC Base, JPC Shoulders, and Concrete for Bridge Decks.
PART:	3)
REVISION:	Replace the "tests" with "test" in the last sentence.
SUBSECTION:	805.05.05 Polish-Resistant Aggregate.
REVISION:	Add the following paragraph: Provide a signed certification from the aggregate producer for the manufactured polish-resistant coarse aggregate stating that the aggregate is supplied from the approved parent material as found on the Department's List of Approved Materials, Polish-Resistant Aggregate Source List and Guidelines on the Division of Materials' webpage.
SUBSECTION:	805.13.01 Cyclopean Stone Riprap and Channel Lining Class III.
REVISION:	Replace the subsection with the following: 805.13.01 Cyclopean Stone Riprap and/or Channel Lining Class III. Provide material meeting the general requirements of Section 805. Ensure that 100 percent passes through a square opening of 16 inches by 16 inches, and no more than 20 percent passes through square openings of 8 inches by 8 inches. The Department may allow stones of smaller sizes for filling voids in the upper surface and dressing to the proper slope.
SUBSECTION:	806.03.01 General Requirements.
TEST:	Dynamic Shear
REVISION:	Replace the 100% pay range "5,000-5,500" with "0-5,500"
SUBSECTION:	806.03.03 Modification.
REVISION:	Replace the first sentence with the following: Use only styrene-butadiene (SB) or styrene-butadiene-styrene (SBS) modifiers.
SUBSECTION:	810.02 APPROVAL.
REVISION:	Replace reference "KM 114" with "KM 115".
SUBSECTION:	810.03.06 Identification and Markings.
REVISION:	Delete the following text from the first paragraph: "When the manufacturer has more than one plant, include the plant letter assigned by the Division of Materials after the date of manufacture as follows: L-Louisville N-London" Delete the following paragraph: "The Department will not require the certification on the shipment approval form to be notarized. The Department will not require the information under "Pipe Data" on the approval form when the manufacture's shipment ticket is attached and contains the necessary information."

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SUBSECTION: 811.02.01 Requirements. REVISION: Replace the subsection with the following: Furnish bar reinforcement for bridges, cast-in-place culverts, and cast-in-place retaining walls that conforms to ASTM A 615 (billet) or ASTM A 996 (rail). ASTM A 706 steel is acceptable with prior approval of the Division of Materials. Do not weld any steel bar reinforcement unless it is ASTM A 706 rebar. The Engineer will accept rail steel bar reinforcement in straight lengths only. Do not use rail steel reinforcement where field bending is allowed or required.
SUBSECTION: 811.09.02 Dowel Bars. REVISION: Replace the reference to "ASTM A 616" with "ASTM A 996" Insert the following sentence between the third and fourth sentence of the first paragraph: Broken or sheared ends are acceptable with prior approval of the Division of Materials.
SUBSECTION: 811.06 BAR MATS. REVISION: Replace the subsection with the following: Conform to ASTM A 184 and fabricate by welding deformed Grade 60 weldable bars.
SUBSECTION: 811.09.02 Dowel Bars. REVISION: Replace the first paragraph with the following: Furnish dowel bars that are plain round bars conforming to ASTM A 706, A 615, A 996, or A 617 with respect to mechanical properties only. Provide either Grade 40, 50 or 60 steel. Saw cut the free ends of the dowels and ensure that they are free of burrs or projections. Broken or sheared ends are acceptable with prior approval of the Division of Materials. Coat dowel bars according to AASHTO M 254 with the following exceptions for Type B coatings:
SUBSECTION: 811.10.02 Epoxy Coating Material. REVISION: Replace both the reference to "ASTM D 3963 Annex" and "ASTM D 3963" with "AASHTO M 284".
SUBSECTION: 812.01.02 Hot-Rolled Carbon Steel Sheets and Strip of Structural Quality, Grade 33 (Corrugated Steel Plank for Bridge Floors). REVISION: Replace the reference to "ASTM A 570" with "ASTM A 1011"

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SUBSECTION: 827.04 SEED.

REVISION: Replace with the following:

827.04 SEED. Conform to the requirements outlined in the “Kentucky Seed Law and Provisions for Seed Certification in Kentucky” and the “Regulations under the Kentucky Seed Law”, with following exceptions:

- 1) Obtain seed only through registered dealers that are permitted for labeling of seed.
- 2) Ensure all deliveries and shipments of premixed seed are accompanied with a master blend sheet.
- 3) Ensure all bags and containers have an acceptable seed tag attached.
- 4) The Department may sample the seed at the job site at any time.

Do not use seed (grasses, native grasses, and legumes) if the weed seed is over one percent, total germination (including hard seed) is less than 80 percent, if the seed test date is over 9 months old exclusive of the month tested, or if the limits of noxious weed seed is exceeded.

Ensure that noxious weed seeds contained in any seed or seed mixture does not exceed the maximum permitted rate of occurrence per pound.

<u>Name of Kind</u>	<u>Max. No. Seeds (per pound)*</u>
Balloon Vine (<i>Cardiospermum halicacabum</i>)	0
Purple Moonflower (<i>Ipomoea turbinata</i>)	0
Canada Thistle (<i>Cirsium Arvense</i>)	0
Johnsongrass (<i>Sorghum halepense</i> and <i>Sorghum almum</i> and perennial rhizomatous derivatives of these species)	0
Quackgrass (<i>Elytrigia Repens</i>)	0
Annual Bluegrass (<i>Poa annua</i>)	120
Buckhorn Plantain (<i>Plantago lanceolata</i>)	120
Corncockle (<i>Agrostemma githago</i>)	18
Dodder (<i>Cuscuta</i> spp.)	18
Giant Foxtail (<i>Setaria faberii</i>)	18
Oxeye Daisy (<i>Chrysanthemum leucanthemum</i>)	120
Sorrel (<i>Rumex acetosella</i>)	120
Wild Onion and Wild Garlic (<i>Allium</i> spp.)	18

* Seed or seed mixtures that contain in excess of 120 total noxious seeds per pound is prohibited

Wildflower seed shall not be planted until approved by the MCL.

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REQUIREMENTS FOR SEEDS			
	Purity (Min. %)	Germination (Min. %) Including Hard Seed and Dormant Seed	Hard Seed (Max. %) Allowed in Germination
Grasses			
Bentgrass (<i>Argrostis palustris</i>)	98	85	-
Bermudagrass, common (<i>Cynodon dactylon</i>)	97	85	-
Bluegrass, Kentucky (<i>Poa pratensis</i>)	98	85	-
Brome, smooth (<i>Bromus inermis</i>)	95	80	-
Canarygrass, reed (<i>Phalaris arundinacea</i>)	95	80	-
Fescue, chewings (<i>Festuca rubra</i> var. <i>commutata</i>)	97	85	-
Fescue, hard (<i>Festuca trachyphlla</i>)	97	85	-
Fescue, meadow (<i>Festuca elatior</i>)	97	85	-
Fescue, red (<i>Festuca rubra</i>)	97	85	-
Fescue, tall (<i>Festuca arundinacca</i>)	97	85	-
Orchardgrass (<i>Dactylis glomerata</i>)	97	85	-
Redtop (<i>Agrostic alba</i>)	95	80	-
Ryegrass, annual, common or Italian (<i>Lotium multiflorum</i>)	97	85	-
Ryegrass, perennial (<i>Lolium perenne</i>)	97	85	-
Lovegrass, Weeping (<i>Eragrostic curvula</i>)	96	80	-
Oat (<i>Avena Sativa</i>)	98	85	-
Rye (<i>Secale cereale</i>)	98	85	-
Timothy (<i>Phleum pratense</i>)	98	85	-
Wheat, common (<i>Triticum aestivum</i>)	98	85	-
Legumes			
Alfalfa (<i>Medicago sativa</i>)	98	85	25
Clover, alsike (<i>Trifolium hybridum</i>)	97	85	25
Clover, ladino (<i>Trifolium repens</i>)	98	85	25
Clover, white (<i>Trifolium repens</i>)	98	85	25
Crownvetch (<i>Coronilla varia</i>)	97	85	25
Lespedeza, Korean (<i>Lespedeza stipulacea</i>)	97	85	20
Lespedeza, Sericea (<i>Lespedeza cuneata</i>)	97	85	20
Sweetclover, white (<i>Melilotus alba</i>)	98	85	25
Sweetclover, yellow (<i>Melilotus officinalis</i>)	98	85	25
Trefoil, birdsfoot (<i>Lotus corniculatus</i>)	97	85	25
Native Grasses			
Little Bluestem (<i>Schizachyrium scoparium</i>)	85	80	-
Big Blustem (<i>Andropogon gerardii</i>)	85	80	-
Indian Grass (<i>Sorghastrum nutans</i>)	85	80	-
Switchgrass (<i>Panicum virgatum</i>)	85	80	-

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<p>SUBSECTION: 827.07 EROSION CONTROL BLANKET. REVISION: Replace the subsection with the following:</p> <p>827.07 EROSION CONTROL BLANKET. Use a blanket from the Department's List of Approved Materials. Blankets must be machine constructed with two-sided netting filled with curled wood fiber mat, straw, or a straw and coconut fiber combination. Ensure the blanket is smolder resistant without the use of chemical additives.</p> <p>A) Dimensions. Furnish in strips with a minimum width of 4 feet and length of 50 feet. B) Weight.</p> <p>1) Curled Wood Fiber. Ensure a minimum mass per unit area of 7.25 ounce per square yard according to ASTM D 6475. 2) Straw. Ensure a minimum mass per unit area of 7.5 ounce per square yard according to ASTM D 6475. 3) Straw/Coconut Fiber. Ensure a minimum mass per unit area of 6.75 pounds per square yard according to ASTM D 6475.</p> <p>C) Fill. Ensure the fill is evenly distributed throughout the blanket.</p> <p>1) Curled Wood Fiber. Use curled wood fiber of consistent thickness with at least 80 percent of its fibers 6 inches or longer in length. 2) Straw. Use only weed free agricultural straw. 3) Straw/Coconut Fiber. Conform to the straw requirements above and ensure the coconut fiber is evenly distributed throughout the blanket and accounts for 30% or more of the fill.</p> <p>D) Netting. Use photodegradable extruded plastic mesh or netting, with a maximum spacing width of one inch square, on both sides of the blanket. Secure the netting by stitching or other method to ensure the blanket retains its integrity. E) Staples. Use steel wire U-shaped staples with a minimum diameter of 0.09 inches (11 gauge), a minimum width of one inch, and a minimum length of 6 inches. Use a heavier gauge when working in rocky or clay soils and longer lengths in sandy soils. Provide staples with colored tops when requested by the Engineer. F) Performance.</p> <p>1) C-Factor. Ensure the ratio of soil loss from protected slope to ratio of soil loss from unprotected is ≤ 0.15 for a slope of 3:1 when tested according to ECTC method 2. 2) Shear Stress. Ensure the blanket can sustain a minimum shear stress of 1.75 pounds per square foot without physical damage or excess erosion (> 0.5 inches soil loss) when tested according to ECTC Method 3.</p>
<p>SUBSECTION: 828.02 APPROVAL. REVISION: Add the following:</p> <p>The Department will continue to include the masonry coatings on the list contingent upon receiving an annual certification containing the following information:</p> <p>1) A statement that the masonry coating to be furnished during the particular calendar year is of the same composition as that previously approved for inclusion on the approved list. 2) A statement that the masonry coating conforms to the appropriate requirements of the Kentucky Standard Specifications for Road and Bridge Construction. 3) A statement that notification will be made to the Division of Materials of any changes in composition for review and approval before furnishing the material to projects.</p>
<p>SUBSECTION: 843.01.02 Acceptance Procedures for Non-Specification Fabric. TABLE: GRAB STRENGTH PAYMENT REDUCTION REVISION: Add the following note:</p> <p>The Department will use the lowest value of MACHINE and CROSS for the reduction calculation.</p>

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SUBSECTION: 844.02.01 Fly Ash. PART: 1) REVISION: Delete the last sentence.
SUBSECTION: 844.02.01 Fly Ash. REVISION: Replace the subsection with the following: 844.02.01 Fly Ash. Select from the Department's List of Approved Materials for fly ash sources. To be placed on the list, furnish samples and ASTM C 618 test data developed over the previous 3 months, and confirm to the requirements in KM 64-325.

PART III

EMPLOYMENT, WAGE AND RECORD REQUIREMENTS

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FEDERAL-AID CONSTRUCTION CONTRACTS**

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ATTACHMENTS

- A. Employment Preference for Appalachian Contracts
(included in Appalachian contracts only)

I. GENERAL

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.

3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.

4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

- Section I, paragraph 2;
- Section IV, paragraphs 1, 2, 3, 4, and 7;
- Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.

6. **Selection of Labor:** During the performance of this contract, the contractor shall not:

a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or

b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

1. **Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630 and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 *et seq.*) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.

b. The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."

2. **EEO Officer:** The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.

3. **Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:

a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin,

age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.

8. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.

c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

9. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and

(4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.

III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

1. General:

a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics

shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. Classification:

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

3. Payment of Fringe Benefits:

a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:

a. Apprentices:

(1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable

classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Helpers:

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under an approved definition, shall be paid not less than the applicable wage rate on the wagedetermination for the classification of work actually performed.

5. Apprentices and Trainees (Programs of the U.S. DOT):

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of

Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. Withholding:

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. Overtime Requirements:

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. Violation:

Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of \$10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. Withholding for Unpaid Wages and Liquidated Damages:

The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any

liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3):

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.

b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;

(2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;

(3) that each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.

f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than \$1,000,000 (23 CFR 635) the contractor shall:

a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.

b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.

c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.

2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).

a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more than \$10,000 or imprisoned not more than 5 years or both."

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

**XI. CERTIFICATION REGARDING DEBARMENT,
SUSPENSION, INELIGIBILITY AND VOLUNTARY
EXCLUSION**

1. Instructions for Certification - Primary Covered Transactions:

(Applicable to all Federal-aid contracts - 49 CFR 29)

a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.

d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which

this proposal is submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Primary Covered Transactions

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

b. Have not within a 3-year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and

d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Covered Transactions:

(Applicable to all subcontracts, purchase orders and other lower tier transactions of \$25,000 or more - 49 CFR 29)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 - 49 CFR 20)

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and

submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

**KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS**

**EMPLOYMENT REQUIREMENTS
RELATING TO
NONDISCRIMINATION OF EMPLOYEES
(APPLICABLE TO FEDERAL-AID SYSTEM CONTRACTS)**

**AN ACT OF THE KENTUCKY GENERAL ASSEMBLY
TO PREVENT DISCRIMINATION IN EMPLOYMENT**

**KRS CHAPTER 344
EFFECTIVE JUNE 16, 1972**

The contract on this project, in accordance with KRS Chapter 344, provides that during the performance of this contract, the contractor agrees as follows:

1. The contractor shall not fail or refuse to hire, or shall not discharge any individual, or otherwise discriminate against an individual with respect to his compensation, terms, conditions, or privileges of employment, because of such individual's race, color, religion, national origin, sex, disability or age (between forty and seventy); or limit, segregate, or classify his employees in any way which would deprive or tend to deprive an individual of employment opportunities or otherwise adversely affect his status as an employee, because of such individual's race, color, religion, national origin, sex, disability or age (between forty and seventy). The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. The contractor shall not print or publish or cause to be printed or published a notice or advertisement relating to employment by such an employer or membership in or any classification or referral for employment by the employment agency, indicating any preference, limitation, specification, or discrimination, based on race, color, religion, national origin, sex, disability or age (between forty and seventy), except that such notice or advertisement may indicate a preference, limitation, or specification based on religion, or national origin when religion, or national origin is a bona fide occupational qualification for employment.

3. If the contractor is in control of apprenticeship or other training or retraining, including on-the-job training programs, he shall not discriminate against an individual because of his race, color, religion, national origin, sex, disability or age (between forty and seventy), in admission to, or employment in any program established to

provide apprenticeship or other training.

4. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representative of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for non-compliance.

REVISED: 12-3-92

EXECUTIVE BRANCH CODE OF ETHICS

In the 1992 regular legislative session, the General Assembly passed and Governor Brereton Jones signed Senate Bill 63 (codified as KRS 11A), the Executive Branch Code of Ethics, which states, in part:

KRS 11A.040 (6) provides:

No present or former public servant shall, within six (6) months of following termination of his office or employment, accept employment, compensation or other economic benefit from any person or business that contracts or does business with the state in matters in which he was directly involved during his tenure. This provision shall not prohibit an individual from returning to the same business, firm, occupation, or profession in which he was involved prior to taking office or beginning his term of employment, provided that, for a period of six (6) months, he personally refrains from working on any matter in which he was directly involved in state government. This subsection shall not prohibit the performance of ministerial functions, including, but not limited to, filing tax returns, filing applications for permits or licenses, or filing incorporation papers.

KRS 11A.040 (8) states:

A former public servant shall not represent a person in a matter before a state agency in which the former public servant was directly involved, for a period of one (1) year after the latter of:

- a) The date of leaving office or termination of employment; or
- b) The date the term of office expires to which the public servant was elected.

This law is intended to promote public confidence in the integrity of state government and to declare as public policy the idea that state employees should view their work as a public trust and not as a way to obtain private benefits.

If you have worked for the executive branch of state government within the past six months, you may be subject to the law's prohibitions. The law's applicability may be different if you hold elected office or are contemplating representation of another before a state agency.

Also, if you are affiliated with a firm which does business with the state and which employs former state executive-branch employees, you should be aware that the law may apply to them.

In case of doubt, the law permits you to request an advisory opinion from the Executive Branch Ethics Commission, Room 136, Capitol Building, 700 Capitol Avenue, Frankfort, Kentucky 40601; telephone (502) 564-7954.

KENTUCKY TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
TRAINING SPECIAL PROVISIONS

This Training Special Provision supersedes subparagraph 7b of the Special Provision entitled "Specific Equal Employment Opportunity Responsibilities," (Attachment 1), and is in implementation of 23 U.S.C. 140(a).

As part of the contractor's equal employment opportunity affirmative action program training shall be provided as follows:

The contractor shall provide on-the-job training aimed at developing full journeymen in the type of trade or job classification involved.

The number of trainees to be trained under these special provisions and in this contract is shown in "Special Notes Applicable to Project" in the bid proposal.

In the event that a contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided, however, that the contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The contractor shall also insure that this training special provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. Prior to commencing construction the contractor shall submit to the Kentucky Transportation Cabinet, Department of Highways for its approval, an acceptable training program on forms provided by the Cabinet indicating the number of trainees to be trained in each selected classification. Failure to provide the Cabinet with the proper documentation evidencing an acceptable training program prior to commencing construction shall cause the Cabinet to suspend the operations of the contractor with (if applicable) working days being charged as usual against the contract time or (if applicable), no additional contract time being granted for the suspension period. The Cabinet will not be liable for the payment of any work performed during the suspension period due to the failure of the contractor to provide an acceptable training program. Said suspension period shall be terminated when an acceptable training program is received by the Cabinet. Furthermore, the contractor shall specify the starting time for training in each of the classifications. The contractor will be credited for each trainee employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeymen status is a primary objective of this Training Special Provision. Accordingly, the contractor shall make every effort to enroll minority trainees and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the contractor's records should document the findings in each case. The minimum length and type of training for each classification will be as established in the training program selected by the contractor and approved by the Kentucky Transportation Cabinet, Department of Highways and the Federal Highway Administration shall approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs

registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the division office. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the contractor will be reimbursed for each hour of training given an employee on this contract in accordance with an approved training program. As approved by the engineer, reimbursement will be made for training persons in excess of the number specified herein. This reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or pays the trainee's wages during the offsite training period.

No payment shall be made to the contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program. It is not required that all trainees be on board for the entire length of the contract. A contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.

The contractor shall furnish the trainee a copy of the program he will follow in providing the training. The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily completed.

The contractor will provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

HIGHWAY BASIC HOURLY RATES	FRINGE BENEFIT PAYMENTS COMBINED
<u>CRAFTS:</u>	
Breckinridge County:	
Bricklayers	25.90.....10.70
Bullitt, Carroll, Grayson, Hardin, Henry, Jefferson, Larue, Marion, Meade, Nelson, Oldham, Shelby, Spencer and Trimble Counties:	
Bricklayers	22.93.....8.85
Bracken, Gallatin, Grant, Mason and Robertson Counties:	
Bricklayers	25.86.....9.49
Boyd, Carter, Elliott, Fleming, Greenup, Lewis and Rowan Counties:	
Bricklayers	25.49.....13.86
Anderson, Bath, Bourbon, Boyle, Clark, Fayette, Franklin, Harrison, Jessamine, Madison, Mercer, Montgomery, Nicholas, Owen, Scott, Washington and Woodford Counties:	
Bricklayers	22.93.....8.85
Bricklayers (Layout Men)	23.18.....8.85
Refractory/Acid Brick/Glass	23.43.....8.85
All Counties	
Carpenters:	23.60.....8.97
Divers	35.78.....8.97
Piledrivermen	23.85.....8.97
Bracken and Grant Counties:	
Millwrights.....	21.90.....7.92
Anderson, Bath, Bourbon, Boyle, Clark, Fayette, Franklin, Harrison, Jessamine, Madison, Mercer, Montgomery, Nicholas, Owen, Scott and Woodford Counties:	
Millwrights.....	21.75.....12.50
Boyd, Carter, Elliott, Fleming, Greenup, Lewis, Mason, Robertson, and Rowan Counties:	
Millwrights.....	29.25.....12.16
Breckinridge, Bullitt, Carroll, Gallatin, Grayson, Hardin, Henry, Jefferson, Larue, Marion, Meade, Nelson, Oldham, Shelby, Spencer, Trimble and Washington Counties:	
Millwrights.....	23.65.....14.22
Bracken, Gallatin and Grant Counties:	
Electricians.....	24.24.....9.34
Sound Communications:	
CablePuller.....	9.00.....2.64
Installer.....	18.00.....3.475

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

HIGHWAY BASIC HOURLY RATES	FRINGE BENEFIT PAYMENTS COMBINED
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CRAFTS: (continued)

Boyd, Carter, Elliott and Rowan Counties:

Electricians:

Cable Splicers	27.46	16.12
Electricians	26.15	16.08

Anderson, Bath, Bourbon, Boyle, Breckinridge, Bullitt, Carroll, Clark, Fayette, Franklin, Grayson, Hardin, Harrison, Henry, Jefferson, Jessamine, Larue, Madison, Marion, Meade, Mercer, Montgomery, Nelson, Nicholas, Oldham, Owen, Robertson, Scott, Shelby, Spencer, Trimble, Washington and Woodford Counties:

Electricians.....	25.91	23.5% + 4.55
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Fleming, Greenup, Lewis and Mason Counties:

Electricians.....	27.94.....	11.35
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Bourbon (Northern third, including Townships of Jackson, Millersburg, Ruddel Mills & Shawhan); Carroll (Eastern third, including the Township of Ghent); Fleming (Western part, excluding Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksville, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford); Mason (Western two-thirds, including Townships of Dover, Lewisburg, Mays Lick, Maysville, Minerva, Moranburg, Murphysville, Ripley, Sardis, Shannon, South Ripley & Washington);

Nicholas (Townships of Barefoot, Barterville, Carlisle, Ellisville, Headquarters, Henryville, Morningglory, Myers & Oakland Mills); Owen (Townships of Beechwood, Bromley, Fairbanks, Holbrook, Jonesville, Long Ridge, Lusby's Mill, New, New Columbus, New Liberty, Owenton, Poplar Grove, Rockdale, Sanders, Teresita & Wheatley); Scott (Northern two-thirds, including Townships of Biddle, Davis, Delaplain, Elmville, Longlick, Muddy Ford, Oxford, Rogers Gap, Sadieville, Skinnersburg & Stonewall) & Bracken, Gallatin, Grant, Harrison & Robertson Counties:

Ironworkers:

Fence Erector	22.52.....	15.35
Structural.....	25.02.....	15.35

Bourbon (Southern two-thirds, including Townships of Austerlity, Centerville, Clintonville, Elizabeth, Hutchison, Littlerock, North Middletown & Paris); Carroll (Western two-thirds, including Townships of Carrollton, Easterday, English, Locust, Louis, Prestonville & Worthville); Clark (Western two-thirds, including Townships of Becknerville, Flanagan, Ford, Pine Grove, Winchester & Wyandotte); Owen (Eastern eighth, including Townships of Glenmary, Gratz, Monterey, Perry Park & Tacketts Mill); Scott (Southern third, including Townships of Georgetown, Great Crossing, Newtown, Stamping Ground & Woodlake); Anderson, Boyle, Breckinridge, Bullitt, Fayette, Franklin, Grayson, Hardin, Henry, Jefferson,

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

HIGHWAY BASIC HOURLY RATES	FRINGE BENEFIT PAYMENTS COMBINED
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CRAFTS: (continued)

Jessamine, Larue, Madison, Marion, Meade, Mercer, Nelson, Oldham, Shelby, Spencer, Trimble, Washington & Woodford Counties:

Ironworkers23.49.....15.99

Bourbon (Northern third, including Townships of Jackson, Millersburg, Ruddel Mills & Shawhan); Carroll (Eastern third, including the Townships of Ghent); Fleming (Western part, excluding Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksrige, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford); Mason (Western two-thirds, including Townships of Dover, Lewisburg, Mays Lick, Maysville, Minerva, Moranburg, Murphysville, Ripley, Sardis, Shannon, South Ripley & Washington); Nicholas (Townships of Barefoot, Barterville, Carlisle, Ellisville, Headquarters, Henryville, Morningglory, Myers & Oakland Mills); Owen (Townships of Beechwood, Bromley, Fairbanks, Holbrook, Jonesville, Long Ridge, Lusby's Mill, New, New Columbus, New Liberty, Owenton, Poplar Grove, Rockdale, Sanders, Teresita & Wheatley); Scott (Northern two-thirds, including Townships of Biddle, Davis, Delaplain, Elmville, Longlick, Muddy Ford, Oxford, Rogers Gap, Sadieville, Skinnersburg & Stonewall); Bracken, Gallatin, Grant, Harrison & Robertson Counties:

Ironworkers:

Up to and including 30- mile radius of Hamilton County, Ohio Courthouse23.70.....14.00

Beyond 30- mile radius of Hamilton County, Ohio Courthouse23.95.....14.00

Clark (Eastern third, including Townships of Bloomingdale, Hunt, Indian Fields, Kiddville, Loglick, Rightangele & Thomson); Fleming (Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksrige, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford); Mason (Eastern third, including Townships of Helena, Marshall, Orangeburg, Plumville & Springdale); Nicholas (Eastern eighth, including the Township of Moorefield Sprout); Bath, Boyd, Carter, Elliott, Greenup, Lewis, Montgomery & Rowan Counties:

Ironworkers:

Zone 126.8715.82

Zone 227.2715.82

Zone 328.8715.82

Zone 1 - Up to 10 mi. radius of union hall, Ashland, KY, 1643 Greenup Avenue;

Zone 2 - 10 to 50 mi. radius of union hall;

Zone 3 - 50 mi. radius and beyond.

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

HIGHWAY BASIC HOURLY RATES	FRINGE BENEFIT PAYMENTS COMBINED
<u>CRAFTS:</u> (continued)	
Anderson, Breckinridge, Bullitt, Carroll, Grayson, Hardin, Henry, Jefferson, Larue, Marion, Meade, Nelson, Oldham, Shelby, Spencer, Trimble and Washington Counties:	
Painters:	
Brush & Roller	17.879.07
Spray, Sand Blast, Power Tools, Water Blast & Steam Cleaning	18.629.07
Bracken, Gallatin, Grant, Mason, and Owen Counties:	
Painters:	
(Heavy and Highway Bridges- Guardrails-Lightpoles-Striping):	
Bridge/Equipment Tender and Containment Builder	20.406.30
Brush and Roller	23.006.30
Elevated Tanks; Steeplejack Work; Bridge & Lead Abatement	
24.00	6.30
Sand Blasting & Water Blasting	23.756.30
Spray	23.506.30
Bath, Bourbon, Boyle, Clark, Fayette, Fleming, Franklin, Harrison, Jessamine, Madison, Mercer, Montgomery, Nicholas, Robertson, Scott and Woodford Counties	
Painters:	
Brush & Roller	21.305.90
Elevated Tanks; Steeplejack Work; Bridge & Lead Abatement	
22.30	5.90
Sandblasting & Waterblasting	22.055.90
Spray	21.805.90
Bridge/Equipment Tender and/or Containment Builder	
18.90	5.90
Boyd, Carter, Elliott, Greenup, Lewis and Rowan Counties	
Painters:	
Bridges	24.9310.90
All Other Work	20.3810.90

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

HIGHWAY BASIC HOURLY RATES	FRINGE BENEFIT PAYMENTS COMBINED
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CRAFTS: (continued)

Breckinridge, Bullitt, Carroll (Western Half), Franklin (Western three-fourths), Grayson, Hardin, Henry, Jefferson, Larue, Marion, Meade, Nelson, Oldham, Shelby, Spencer, Trimble and Washington Counties:

Plumber 27.20 12.47

Boyd, Carter, Elliott, Greenup, Lewis and Rowan Counties:

Plumbers and Steamfitters 24.61 15.98

Bracken, Carroll (Eastern Half), Gallatin, Grant, Mason, Owen and Robertson Counties:

Pipefitters and Plumbers 26.93 12.61

LABORERS:

Bath, Bourbon, Boyd, Boyle, Bracken, Carter, Clark, Elliott, Fayette, Fleming, Franklin, Gallatin, Grant, Greenup, Harrison, Jessamine, Lewis, Madison, Mason, Mercer, Montgomery, Nicholas, Owen, Robertson, Rowan, Scott, & Woodford Counties:

GROUP 1 - Aging and curing of concrete, Asbestos Abatement Worker, Asphalt Plant, Asphalt, Batch Truck Dump, Carpenter Tender, Cement Mason Tender, Cleaning of Machines, Concrete, Demolition, Dredging, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Level D, Flagperson, Grade Checker, Hand Digging and Hand Back Filling, Highway Marker Placer, Landscaping Mesh Handler and Placer, Puddler, Railroad, Rip-Rap and Grouter, Right-of-Way Sign, Guard rail and Fence Installer, Signal Person, Sound Barrier Installer, Storm and Sanitary Sewer, Swamper, Truck Spotter and Dumper, and Wrecking of Concrete Forms, General Cleanup.

BASE RATE 19.33

FRINGE BENEFITS 9.18

Group 2 - Batter Board Man (Sanitary And Storm Sewer), Brickmason Tender, Mortar Mixer Operator, Scaffold Builder, Burner and Welder, Bushhammer, Chain Saw Operator, Concrete Saw Operator, Deckhand Scow Man, Dry Cement Handler, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Level C, Forklift Operator for Masonary, Form Setter, Green Concrete Cutting, Hand Operated Grouter and Grinder Machine Operator, Jackhammer, Pavement Breaker, Paving Joint Machine, Pipelayer, Plastic Pipe Fusion, Power Driven Georgia Buggy and Wheel Barrow, Power Post Hole Digger, Precast Manhole Setter, Walk-Behind Tamper, Walk-Behind Trencher, Sand Blaster, Concrete Chipper, Surface Grinder, Vibrator Operator and Wagon Driller.

BASE RATE 19.58

FRINGE BENEFITS 9.18

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

LABORERS: (continued)

GROUP 3 - Asphalt Luteman and Raker, Gunnite Nozzleman, Gunnite Operator and Mixer, Grout Pump Operator, Side Rail Setter, Rail Paved Ditch, Screw Operator, Tunnel (Free Air) and Water Blaster.

BASE RATE19.63
FRINGE BENEFITS9.18

GROUP 4 - Caisson Worker (Free Air), Cement Finisher, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Levels A and B, Miner and Driller (Free Air), Tunnel Blaster and Tunnel Mucker (Free Air), Directional & Horizontal Boring, Air Track Drillers (all types), Powdermen & Blasters, Troxler & Concrete Tester if Laborer is Utilized.

BASE RATE20.23
FRINGE BENEFITS9.18

LABORERS:

Anderson, Bullitt, Carroll, Hardin, Henry, Jefferson, Larue, Marion, Meade, Nelson, Oldham, Shelby, Spencer, Trimble & Washington Counties:

GROUP 1 - Aging and curing of concrete, Asbestos Abatement Worker, Asphalt Plant, Asphalt, Batch Truck Dump, Carpenter Tender, Cement Mason Tender, Cleaning of Machines, Concrete, Demolition, Dredging, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Level D, Flagperson, Grade Checker, Hand Digging and Hand Back Filling, Highway Marker Placer, Landscaping Mesh Handler and Placer, Puddler, Railroad, Rip-Rap and Grouter, Right-of-Way Sign, Guard rail and Fence Installer, Signal Person, Sound Barrier Installer, Storm and Sanitary Sewer, Swamper, Truck Spotter and Dumper, and Wrecking of Concrete Forms, General Cleanup.

BASE RATE19.33
FRINGE BENEFITS9.18

Group 2 - Batter Board Man (Sanitary And Storm Sewer), Brickmason Tender, Mortar Mixer Operator, Scaffold Builder, Burner and Welder, Bushhammer, Chain Saw Operator, Concrete Saw Operator, Deckhand Scow Man, Dry Cement Handler, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Level C, Forklift Operator for Masonary, Form Setter, Green Concrete Cutting, Hand Operated Grouter and Grinder Machine Operator, Jackhammer, Pavement Breaker, Paving Joint Machine, Pipelayer, Plastic Pipe Fusion, Power Driven Georgia Buggy and Wheel Barrow, Power Post Hole Digger, Precast Manhole Setter, Walk-Behind Tamper, Walk-Behind Trencher, Sand Blaster, Concrete Chipper, Surface Grinder, Vibrator Operator and Wagon Driller.

BASE RATE19.58
FRINGE BENEFITS9.18

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

LABORERS: (continued)

GROUP 3 - Asphalt Luteman and Raker, Gunnite Nozzleman, Gunnite Operator and Mixer, Grout Pump Operator, Side Rail Setter, Rail Paved Ditch, Screw Operator, Tunnel (Free Air) and Water Blaster.

BASE RATE19.63
FRINGE BENEFITS9.18

GROUP 4 - Caisson Worker (Free Air), Cement Finisher, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Levels A and B, Miner and Driller (Free Air), Tunnel Blaster and Tunnel Mucker (Free Air), Directional & Horizontal Boring, Air Track Drillers (all types), Powdermen & Blasters, Troxler & Concrete Tester if Laborer is Utilized.

BASE RATE20.23
FRINGE BENEFITS9.18

LABORERS:

Breckinridge & Grayson Counties:

GROUP 1 - Aging and curing of concrete, Asbestos Abatement Worker, Asphalt Plant, Asphalt, Batch Truck Dump, Carpenter Tender, Cement Mason Tender, Cleaning of Machines, Concrete, Demolition, Dredging, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Level D, Flagperson, Grade Checker, Hand Digging and Hand Back Filling, Highway Marker Placer, Landscaping Mesh Handler and Placer, Puddler, Railroad, Rip-Rap and Grouter, Right-of-Way Sign, Guard rail and Fence Installer, Signal Person, Sound Barrier Installer, Storm and Sanitary Sewer, Swamper, Truck Spotter and Dumper, and Wrecking of Concrete Forms, General Cleanup.

BASE RATE19.88
FRINGE BENEFITS8.63

Group 2 - Batter Board Man (Sanitary And Storm Sewer), Brickmason Tender, Mortar Mixer Operator, Scaffold Builder, Burner and Welder, Bushhammer, Chain Saw Operator, Concrete Saw Operator, Deckhand Scow Man, Dry Cement Handler, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Level C, Forklift Operator for Masonary, Form Setter, Green Concrete Cutting, Hand Operated Grouter and Grinder Machine Operator, Jackhammer, Pavement Breaker, Paving Joint Machine, Pipelayer, Plastic Pipe Fusion, Power Driven Georgia Buggy and Wheel Barrow, Power Post Hole Digger, Precast Manhole Setter, Walk-Behind Tamper, Walk-Behind Trencher, Sand Blaster, Concrete Chipper, Surface Grinder, Vibrator Operator and Wagon Driller.

BASE RATE20.13
FRINGE BENEFITS8.63

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

LABORERS: (continued)

GROUP 3 - Asphalt Luteman and Raker, Gunnite Nozzleman, Gunnite Operator and Mixer, Grout Pump Operator, Side Rail Setter, Rail Paved Ditch, Screw Operator, Tunnel (Free Air) and Water Blaster.

BASE RATE20.18
FRINGE BENEFITS8.63

GROUP 4 - Caisson Worker (Free Air), Cement Finisher, Environmental - Nuclear, Radiation, Toxic and Hazardous Waste - Levels A and B, Miner and Driller (Free Air), Tunnel Blaster and Tunnel Mucker (Free Air), Directional & Horizontal Boring, Air Track Drillers (all types), Powdermen & Blasters, Troxler & Concrete Tester if Laborer is Utilized.

BASE RATE20.78
FRINGE BENEFITS8.63

TRUCK DRIVER CLASSIFICATIONS:

BASE RATE

GROUP 1 - Mobile Batch Truck Tender 16.57

GROUP 2 - Greaser, Tire Changer and Mechanic Tender 16.68

GROUP 3 - Single Axle Dump, Flatbed, Semi-trailer or Pole Trailer when used to pull building materials and equipment, Tandem Axle Dump, Distributor, Mixer and Truck Mechanic 16.86

GROUP 4 - Euclid & Other Heavy Earthmoving Equipment & Lowboy, Articulator Cat, 5-Axle Vehicle, Winch & A-Frame when used in transporting materials, Ross Carrier, Forklift when used to transport building materials and Pavement Breaker16.96

FRINGE BENEFITS.....7.34

OPERATING ENGINEERS:

A-Frame Winch Truck, Auto Patrol, Backfiller, Batcher Plant, Bituminous Paver, Bituminous Transfer Machine, Boom Cat, Bulldozer, Mechanic, Cableway, Carry-All Scoop, Carry Deck Crane, Central Compressor Plant, Clamshell, Concrete Mixer (21 Cu. Ft. or Over), Concrete Paver, Truck-Mounted Concrete Pump, Core Drill, Crane, Crusher Plant, Derrick, Derrick Boat, Ditching and Trenching Machine, Dragline, Dredge Operator, Dredge Engineer, Elevating Grader and Loaders, Grade-All, Gurries, Heavy Equipment Robotics Operator/Mechanic, High Lift, Hoe-Type Machine, Hoist (two or more drums), Hoisting Engine (two or more drums), Horizontal Directional Drill Operator, Hydrocrane, Hyster, Kecal Loader, Letourneau, Locomotive,

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

OPERATING ENGINEERS: (continued)

Mechanically Operated Laser Screed, Mechanic Welder, Mucking Machine, Motor Scraper, Orangepeel Bucket, Piledriver, Power Blade, Pumpcrete, Push Dozer, Rock Spreader Attached to Equipment, Rotary Drill, Roller (Bituminous), Scarifier, Scoopmobile, Shovel, Side Boom, Subgrader, Tailboom, Telescoping Type Forklift, Tow or Push Boat, Tower Crane (French, German and other types), Tractor Shovel and Truck Crane, Tunnel Mining Machines, Including Moles, Shields or similar types of Tunnel Mining Equipment.

BASE RATE22.95
FRINGE BENEFITS11.90

Air Compressor (over 900 cu. ft. per min.), Bituminous Mixer, Boom Type Tamping Machine, Bull Float, Concrete Mixer (under 21 cu. ft.), Dredge Engineer, Electric Vibrator Compactor/Self-Propelled Compactor, Elevator (one drum or Buck Hoist), Elevator (when used to hoist building material), Finish Machine, Fireman & Hoist (one drum), Flexplane, Forklift (regardless of lift height), Form Grader, Joint Sealing Machine, Outboard Motor Boat, Power Sweeper (riding type), Roller (rock), Ross Carrier, Skid Mounted Or Trailer Mounted Concrete Pump, Skid Steer Machine with all attachments, Switchman or Brakeman, Throttle Valve Person, Tractair and Road Widening Trencher, Tractor (50 H.P. or over), Truck Crane Oiler, Tugger, Welding Machine, Well Points and Whirley Oiler.

BASE RATE20.53
FRINGE BENEFITS11.90

All off road material handling equipment, including Articulating Dump Trucks, Greaser on Grease facilities servicing heavy equipment.

BASE RATE20.91
FRINGE BENEFITS11.90

Bituminous Distributor, Burlap and Curing Machine, Cement Gun, Concrete Saw, Conveyor, Deckhand Oiler, Grout Pump, Hydraulic Post Driver, Hydro Seeder, Mud Jack, Oiler, Paving Joint Machine, Power Form Handling Equipment, Pump, Roller (Earth), Steerman, Tamping Machine, Tractor (under 50 H.P.) and Vibrator.

BASE RATE20.27
FRINGE BENEFITS11.90

Cranes - with Booms 150 ft. and over (including jib), and where the length of the Boom in combination with the length of the piling leads equals or exceeds 150 ft. - \$1.00 over Group 1 rate.

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

Employees assigned to work below ground level are to be paid 10% above basic wage rate. This does not apply to open cut work.

WELDERS - Receive rate for craft in which welding is incidental.

Fringe benefit amounts are applicable for all hours worked except when otherwise noted.

These rates are listed pursuant to Kentucky Determination No. CR-05-III HWY dated May 16, 2006 and/or Federal Decision Number KY20070027 dated February 9, 2007 modification #1 dated May 4, 2007, modification #2 dated June 1, 2007 and modification #3 dated July 6, 2007.

No laborer, workman or mechanic shall be paid at a rate less than that of a Journeyman except those classified as bona fide apprentices.

Apprentices or trainees shall be permitted to work as such subject to Administrative Regulations adopted by the Commissioner of Workplace Standards. Copies of these regulations will be furnished upon request from any interested person.

Before using apprentices on the job the contractor shall present to the Contracting Officer written evidence of registration of such employees in a program of a State apprenticeship and training agency approved and recognized by the U. S. Bureau of Apprenticeship and Training. In the absence of such a State agency, the contractor shall submit evidence of approval and registration by the U. S. Bureau of Apprenticeship and Training.

The contractor shall submit to the Contracting Officer, written evidence of the established apprenticeship-journeyman ratios and wage rates in the project area, which will be the basis for establishing such ratios and rates for the project under the applicable contract provisions.

**TRANSPORTATION CABINET
DIVISION OF CONSTRUCTION PROCUREMENT
COMPLIANCE SECTION
PROJECT WAGE RATES**

TO: EMPLOYERS/EMPLOYEES

PREVAILING WAGE SCHEDULE:

The wages indicated on this wage schedule are the least permitted to be paid for the occupations indicated. When an employee works in more than one classification, the employer must record the number of hours worked in each classification at the prescribed hourly base rate.

OVERTIME:

Overtime is to be paid after an employee works eight (8) hours a day or forty (40) hours a week, whichever gives the employee the greater wages. At least time and one-half the base rate is required for all overtime. A laborer, workman or mechanic and an employer may enter into a written agreement or a collective bargaining agreement to work more than eight (8) hours a calendar day but not more than ten (10) hours a calendar day for the straight time hourly rate. Wage violations or questions should be directed to the designated Engineer or the undersigned.

Steve Waddle, Director
Division of Construction Procurement
Frankfort, Kentucky 40622

**NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY
(Executive Order 11246)**

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

GOALS FOR MINORITY PARTICIPATION IN EACH TRADE	GOALS FOR FEMALE PARTICIPATION IN EACH TRADE
11.2%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally-assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4, 3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within ten (10) working days of award of any construction subcontract in excess of \$10,000.00 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed. The notification shall be mailed to:

**Evelyn Teague, Regional Director
Office of Federal Contract Compliance Programs
61 Forsyth Street, SW, Suite 7B75
Atlanta, Georgia 30303-8609**

4. As used in this Notice, and in the contract resulting from this solicitation, the "**covered area**" is Jefferson County.

PART IV
INSURANCE

INSURANCE

The Contractor shall carry the following insurance in addition to the insurance required by law:

1. Contractor's Public Liability Insurance not less than \$100,000.00 for damages arising out of bodily injuries to or death to one person. Not less than \$300,000.00 for damages arising out of bodily injuries to or death to two or more persons.
2. Contractor's Property Damages Liability Insurance. Not less than \$100,000.00 for all damages arising out of injury or destruction of property in any one accident. Not less than \$300,000.00 for all damages during the policy period.
3. Contractor's Protective Public Liability and Property Damage Insurance. The contractor shall furnish evidence with respect to operations performed for him by subcontractors that he carries in his own behalf for the above stipulated amounts.
4. The insurance required above must be evidenced by a Certificate of Insurance and this Certificate of Insurance must contain one of the following statements:
 - a. "policy contains no deductible clauses."
 - b. "policy contains _____ (amount) deductible property damage clause but company will pay claim and collect the deductible from the insured."
5. WORKMEN'S COMPENSATION INSURANCE. The contractor shall furnish evidence of coverage of all his employees or give evidence of self-insurance by submitting a copy of a certificate issued by the Workmen's Compensation Board.

PART V

STATEMENT OF INCOMPLETE WORK

STATEMENT OF INCOMPLETED WORK

All active prime contracts must be reported. This includes prime contracts with public and private owners and joint-ventured contracts. The names of the joint venturers must be shown when reporting these projects. A machine or typed listing reporting the status of each contract is acceptable when attached to this report; however, the total amounts on the itemized listing must be reported in the space provided below:

CONTRACT WITH	PROJECT IDENTIFICATION	PRIME CONTRACT AMOUNT	EARNINGS THROUGH LAST APPROVED ESTIMATE	TOTAL AMOUNT OF WORK REMAINING
TOTAL (Attach Summary if not itemized above)		\$	\$	\$

PART VI

BID ITEMS

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 1

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
		PAVING			.	.
0010	00003	CRUSHED STONE BASE	429.00	TON	.	.
0020	00020	TRAFFIC BOUND BASE	700.00	TON	.	.
0030	00190	LEVELING & WEDGING PG64-22	216.00	TON	.	.
0040	00221	CL2 ASPH BASE 0.75D PG64-22	169.00	TON	.	.
0050	02069	JPC PAVEMENT-10 INCH	543.00	SQYD	.	.
		ROADWAY			.	.
0060	02014	BARRICADE-TYPE III	4.00	EACH	.	.
0070	02159	TEMPORARY DITCH	1,295.00	LF	.	.
0080	02200	ROADWAY EXCAVATION	110,059.00	CUYD	.	.
0090	02203	STRUCTURE EXCAV-UNCLASSIFIED	585.00	CUYD	.	.
0100	02242	WATER FOR DUST CONTROL	139.00	MGAL	.	.
0110	02275	FENCE-8 FT CHAIN LINK TO RESTRICT ACCESS TO WORKSITE	1,628.00	LF	.	.
0120	02287	DOUBLE VEHICULAR CHAIN LINK GATE	2.00	EACH	.	.
0130	02545	CLEARING AND GRUBBING 3.2 ACRES	1.00	LS	.	.
0140	02562	SIGNS	259.00	SQFT	.	.
0150	02650	MAINTAIN & CONTROL TRAFFIC	1.00	LS	.	.
0160	02726	STAKING	1.00	LS	.	.
0170	02894	CRASH CUSHION TYPE VI-T	1.00	EACH	.	.
0180	03171	CONCRETE BARRIER WALL TYPE 9T	614.00	LF	.	.
0190	05952	TEMPORARY MULCH	1,604.00	SQYD	.	.
0200	05953	TEMP SEEDING AND PROTECTION	1,604.00	SQYD	.	.
0210	08104	CONCRETE-CLASS AA	178.00	CUYD	.	.
0220	08150	STEEL REINFORCEMENT	10,546.00	LB	.	.
0230	10020NS	FUEL ADJUSTMENT	8,254.00	DOLL	1.0000	8,254.00

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 2

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
0240	22188EN	VISUAL BARRIER FENCE-8 FT TO PROVIDE VISUAL BARRIER AT BRIDGEPOINTE (STOCKADE FENCE)	1,255.00	LF	.	.
0250	22580NN	QC-EXPLORATORY TUNNEL DRAINAGE	1.00	LS	.	.
0260	00440	ENTRANCE PIPE-15 INCH	48.00	LF	.	.
0270	00464	CULVERT PIPE-24 INCH	40.00	LF	.	.
0280	02483	CHANNEL LINING CLASS II	1,176.00	TON	.	.
0290	02484	CHANNEL LINING CLASS III	96.00	TON	.	.
0300	02701	TEMPORARY SILT FENCE	360.00	LF	.	.
0310	02703	SILT TRAP TYPE A	6.00	EACH	.	.
0320	02704	SILT TRAP TYPE B	4.00	EACH	.	.
0330	02706	CLEAN SILT TRAP TYPE A	18.00	EACH	.	.
0340	02707	CLEAN SILT TRAP TYPE B	12.00	EACH	.	.
0350	02709	CLEAN TEMPORARY SILT FENCE	1,080.00	LF	.	.
0360	02711	SEDIMENTATION BASIN	1,755.00	CUYD	.	.
0370	02712	CLEAN SEDIMENTATION BASIN	6.00	CUYD	.	.
0380	05950	EROSION CONTROL BLANKET	1,761.00	SQYD	.	.
0390	20496NS843	SILT TRAP TYPE C	2.00	EACH	.	.
0400	20497NS843	CLEAN SILT TRAP TYPE C	6.00	EACH	.	.
0410	22065NN	WEIR AND SKIMMER PLATE	1.00	LS	.	.
0420	22437NN	BASIN PUMP	1.00	LS	.	.
0430	22522ES213	CLEAN SEDIMENTATION BASIN UTILITY	6.00	EACH	.	.
0440	01081	STEEL ENCASEMENT PIPE-24 INCH	30.00	LF	.	.
0450	01099	DUCTILE IRON PIPE-12 INCH	39.67	LF	.	.
0460	01099	DUCTILE IRON PIPE-12 INCH RESTRAINED JOINT	260.00	LF	.	.

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 3

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
0470	02606	FIRE HYDRANT	2.00	EACH	.	.
0480	03472	TIE-IN 12 INCH	1.00	EACH	.	.
0490	03532	GATE VALVE-12 INCH	4.00	EACH	.	.
		LIGHTING			.	.
0500	20454NS835	TEMPORARY LIGHTING	1.00	LS	.	.
		GEOTECHNICAL INVESTIGATION			.	.
0510	22233NN	TUNNEL VENT & UTIL-INSTALL	1.00	LS	.	.
0520	22234EN	TUNNEL VENT & UTIL-DURING EXC	1,800.00	LF	.	.
0530	22238NN	EXPLTRY PROBE HOLE DRILLING-SETUP	45.00	EACH	.	.
0540	22239EN	EPHD-TOTAL LENGTH- 0 TO 50 FT	2,170.00	LF	.	.
0550	22240EN	EPHD-TOTAL LENGTH- 50 TO 100 FT	1,210.00	LF	.	.
0560	22241EN	EPHD-TOTAL LENGTH- 100 TO 200 FT	1,860.00	LF	.	.
0570	22242EN	EPHD-TOTAL LENGTH- 200 TO 300 FT	675.00	LF	.	.
0580	22243EN	EPHD-TOTAL LENGTH- 300 TO 400 FT	85.00	LF	.	.
0590	22244EN	EXPLORATORY PROBE HOLE DRILLING GROUTING	6.30	TON	.	.
0600	22245NN	EXPLORATORY CORE HOLE DRILLING-SETUP	24.00	EACH	.	.
0610	22246EN	ECHD-TOTAL LENGTH- 20 TO 50 FT	1,188.00	LF	.	.
0620	22247EN	ECHD-TOTAL LENGTH- 50 TO 100 FT	928.00	LF	.	.
0630	22248EN	ECHD-TOTAL LENGTH- 100 TO 200 FT	1,494.00	LF	.	.
0640	22249EN	ECHD-TOTAL LENGTH- 200 TO 300 FT	667.00	LF	.	.
0650	22250EN	ECHD-TOTAL LENGTH- 300 TO 400 FT	45.00	LF	.	.
0660	22251EN	ECHD-COREHOLE GROUTING	8.40	TON	.	.
0670	22252NN	WATER PRESSURE TESTING	218.00	EACH	.	.
0680	22253NN	PWS-SUPPLY-INSTALL & OPERATE	3.00	EACH	.	.
		PERFORATED WATER SPRAYER			.	.
0690	22254NN	PWS-MAINTAIN SINGLE INSTALLATION	22.00	EACH	.	.
		PERFORATED WATER SPRAYER			.	.

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 4

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
0700	22255NN	PWS-BASE INSTALLATION READER	3.00	EACH	.	.
		PERFORATED WATER SPRAYER				
0710	22258EN	DOWNHOLE TELEVIEWER SURVEY	1,500.00	LF	.	.
0720	22259NN	ACCESS IN-TUNNEL ELEC RESISTIVITY SURVEY	1.00	LS	.	.
0730	22260EN	GEOTECH INVESTIGATION HOLE GROUTING	3.00	TON	.	.
0740	22261NN	TUNNEL PHOTOGRAPHIC SURVEY PHASE 1	1.00	LS	.	.
		PORTAL ROCK CUT AND IN-TUNNEL: SB 50+00 TO SB 55+00				
0750	22262NN	TUNNEL PHOTOGRAPHIC SURVEY PHASE 2	1.00	LS	.	.
		SB 55+00 TO SB 61+70				
0760	22263NN	TUNNEL PHOTOGRAPHIC SURVEY PHASE 3	1.00	LS	.	.
		SB 61+70 TO SB 68+40				
0770	22264NN	REPORTING AND ANALYSIS PHASE 1	1.00	LS	.	.
		PORTAL ROCK CUT AND IN-TUNNEL: SB 50+00 TO SB 55+00				
0780	22265NN	REPORTING AND ANALYSIS PHASE 2	1.00	LS	.	.
		SB 55+00 TO SB 61+70				
0790	22266NN	REPORTING AND ANALYSIS PHASE 3	1.00	LS	.	.
		SB 61+40 TO SB 68+40				
0800	22267NN	REPORTING AND ANALYSIS-FINAL	1.00	LS	.	.
0810	22268EN	STEEL FIBER SHOTCRETE	700.00	SQFT	.	.
		PORTAL FACE				
0820	22269NN	WEEP HOLE IN FIBER SHOTCRETE	30.00	EACH	.	.
		PORTAL FACE				
0830	22270EN	ET MANDATORY SHOTCRETE WITHIN TY P SUPP	1,080.00	SQFT	.	.
0840	22271EN	ET MANDATORY SHOTCRETE WITHIN TY M SUPP	9,000.00	SQFT	.	.
0850	22272EN	ET SHOTCRETE WITHIN TY II-III & DS SUPRT	35,000.00	SQFT	.	.
0860	22273EN	ET SHOTCRETE-WITHIN TY EBC SUPPORT	8,780.00	SQFT	.	.
0870	22274EN	SPLMNTL SUPPORT WITHIN TY I-II-III DSS	10,500.00	SQFT	.	.
		3 INCHES				
0880	22275EN	SPLMNTL SUPPORT WITHIN TY EBC SUPPORT	2,112.00	SQFT	.	.
		4 INCHES				

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 5

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
0890	22276EN	SPLMNTL SUPPORT-FIBER SHOTCRETE	25.00	CUYD	.	.
0900	22277NN	SURVEY TARGET-SUPPLY AND INSTALL PORTAL FACE	10.00	EACH	.	.
0910	22278NN	SURVEY TARGET-INIT CALIBRATION READING PORTAL FACE	10.00	EACH	.	.
0920	22279NN	SRF MON PT ARRAY-SUPPLY & INST 5-PT ARRY	5.00	EACH	.	.
0930	22280NN	SRF MON PT ARRAY-INIT CALIBRATION READ	5.00	EACH	.	.
0940	22281NN	SRF STLMNT MK-SUPPLY & INSTALL 4-PT ARRY	8.00	EACH	.	.
0950	22282NN	SRF STLMNT MK-INIT CALIBRATION READING	8.00	EACH	.	.
0960	22283NN	FLOWMETER-SUPPLY-INSTALL & MAINTAIN	3.00	EACH	.	.
0970	22284NN	WEATHER STA-SUPPLY-INSTALL & MAINTAIN	1.00	EACH	.	.
0980	22289NN	PIEZO SRF LVL IN EX WELLS	15.00	EACH	.	.
0990	22291NN	DEEP BENCHMARK INTO ROCK	1.00	EACH	.	.
1000	22292NN	CNVRG ARRY SRVY TGT-SUP & INST 5-PT ARRY	25.00	EACH	.	.
1010	22293NN	CNVRG ARRY SRVY TGT-SUP & INST 6-PT ARRY	30.00	EACH	.	.
1020	22294NN	CNVRG ARRY SRVY TGT-INIT RDING 5-PT ARRY	25.00	EACH	.	.
1030	22295NN	CNVRG ARRY SRVY TGT-INIT RDING 6-PT ARRY	30.00	EACH	.	.
1040	22296NN	CNVRG ARY TAPE EXTENSOMETER	1.00	EACH	.	.
1050	22297NN	CNVRGE ARY TAPE EXTEN-SUP & INS 5-PT ARY TUNNEL 5 STATIONS WITH 5 PINS	25.00	EACH	.	.
1060	22298NN	CNVRG ARY TAPE EXTEN-INITIAL RDING	5.00	EACH	.	.
1070	22299NN	DUAL HT WIRE EXTEN-SUPPLY & INST 2 FT	10.00	EACH	.	.
1080	22300NN	DUAL HT WIRE EXTEN-SUPPLY & INST 8 FT	5.00	EACH	.	.
1090	22301NN	DUEL HT WIRE EXTEN-INIT RDING SUPPLY AND INSTALL, (HOLE DEPTH 16 FEET), ANCHORS AT 2, 7, 15FT WIRE	5.00	EACH	.	.
1100	22302NN	MULTI PT BREHOLE EXTEN-3 POINT SUPPLY AND INSTALL, (HOLE DEPTH 21 FEET), ANCHORS AT 2, 8, 20 FT WIRE	2.00	EACH	.	.
1110	22303NN	MULTI PT BREHOLE EXTEN-3 PT INIT RDING	2.00	EACH	.	.

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 6

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
1120	22304NN	MULTI PT BREHOLE EXTEN-4 POINT SUPPLY AND INSTALL, HOLE DEPTH 28 FEET, ANCHORS AT 2, 5, 18, 27FT WIRE	9.00	EACH	.	.
1130	22305NN	MULTI PT BREHOLE EXTEN-4 PT INIT RDING	9.00	EACH	.	.
1140	22306NN	PIEZOMETER-IN TUNNEL	7.00	EACH	.	.
1150	22307NN	PIEZOMETER-IN TUNNEL-INIT RDING	7.00	EACH	.	.
1160	22308NN	BOREHOLE INSPECTION CAMERA-SUPPLY	1.00	EACH	.	.
1170	22309NN	ROCK BOLT TRIALS	1.00	LS	.	.
1180	22310NN	AUTO RMT RDOUT TRANSDUCER-EXTENSOMET	2.00	EACH	.	.
1190	22311NN	AUTO RMT RDOUT TRANS-IN-TUNNEL PIEZO	7.00	EACH	.	.
1200	22312NN	AUTO RMT RDOUT TRANS-SRF PIEZO	15.00	EACH	.	.
1210	22313NN	AUTOMATIC DATA ACQUISITION SYSTEM	1.00	EACH	.	.
1220	22314EN	TUNNEL PORTAL SUPPORT TY P (MAND)	30.00	LF	.	.
1230	22315EN	EXCV REQ SPT TY M (UNDER US42 MAND)	250.00	LF	.	.
1240	22316EN	EXCV REQ SUPPORT TY I	225.00	LF	.	.
1250	22317EN	EXCV REQ SUPPORT TY II	313.00	LF	.	.
1260	22318EN	EXCV REQ SUPPORT TY III	702.00	LF	.	.
1270	22319EN	EXCV REQ SUPPORT TY EBC	200.00	LF	.	.
1280	22320EN	EXCV REQ SUPPORT TY DSS	80.00	LF	.	.
1290	22321EN	DISCRETE ROCKFALLS 1.5 FT BEYOND A-LINE	10.00	CUYD	.	.
1300	22322EN	INVERT CONCRETE	11,161.40	SQFT	.	.
1310	22323NN	REMOVAL OF WATER-PUMPING-0 TO 15 GAL/MIN	726.00	EACH	.	.
1320	22327NN	WATER TREATMENT	1.00	LS	.	.
1330	22328EN	PIPE FOR DIV OF DISSOLUTION CH GW INFLOW	500.00	LF	.	.
1340	22329NN	ROUTINE OR INSTRUCTED ADD DRILLING SETUP	181.00	EACH	.	.
1350	22330NN	ROUTINE OR INSTRUCT ADD GROUTING SETUP	181.00	EACH	.	.
1360	22331EN	PROBE DRILLING-TOTAL LENGTH-0 TO 20 FT	4,000.00	LF	.	.

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 7

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
1370	22332EN	PROBE DRILLING-TOTAL LENGTH-20 TO 100 FT	1,600.00	LF	.	.
1380	22333EN	PROBE DRILLING-TOTAL LENGTH-100-150 FT	495.00	LF	.	.
1390	22334EN	PROBE HOLE GROUTING	6.30	TON	.	.
1400	22335NN	GROUT HOLE DRILLING SETUP	6.00	EACH	.	.
1410	22336EN	GROUT HOLE DRILLING-DRILLING	4,320.00	LF	.	.
1420	22337NN	GROUT HOLE GROUTING SETUP	6.00	EACH	.	.
1430	22338EN	GROUT HOLE GROUTING-GROUTING	121.30	TON	.	.
1440	22339NN	WATER PRESSURE TEST HOLES	281.80	EACH	.	.
1450	22340EN	PORTAL FACES-PROTECTION MESH REINF	4,410.00	SQFT	.	.
1460	22341NN	PORTAL FACES-STEEL ROCK BOLT-10 FT EMB	120.00	EACH	.	.
1470	22342NN	PORTAL FACES-STEEL ROCK BOLT-20 FT EMB	50.00	EACH	.	.
1480	22343EN	ET ROCK REINF IN TY P SUPRT @ PORTAL	30.00	LF	.	.
1490	22344EN	ET ROCK REINF IN SUPPORT TY IV UNDER US 42	250.00	LF	.	.
1500	22345EN	ET ROCK REINF IN SUPPORT TY I	225.00	LF	.	.
1510	22346EN	ET ROCK REINF IN SUPPORT TY II	313.00	LF	.	.
1520	22347EN	ET ROCK REINF IN SUPPORT TY III	702.00	LF	.	.
1530	22348EN	EXPL BAYS-ROCK REINF IN SUPRT TY EBC	200.00	LF	.	.
1540	22349EN	CANOPY TUBES-EMBEDDED LGTH-0 TO 20 FT	100.00	LF	.	.
1550	22350EN	CANOPY TUBES-EMBEDDED LGTH-20 TO 40 FT	1,040.00	LF	.	.
1560	22351EN	SELF DRL RCK ANCHRS-EMBD LGTH-0 TO 20 FT	2,160.00	LF	.	.
1570	22352EN	SELF DRL RCK ANCHRS-EMBD LGTH-20-40 FT	100.00	LF	.	.
1580	22353EN	STEEL RIBS & ACCESSORIES	20.00	TON	.	.
1590	22354EN	WELDED WIRE FABRIC	2,878.40	SQFT	.	.
1600	22355NN	FIBERGLASS ROCK BOLTS-8 FT EMBED LENGTH 50 INCLUDED FOR SUPPLEMENTAL SUPPORT	130.00	EACH	.	.
1610	22356NN	FIBERGLASS ROCK BOLTS-10 FT EMBED LGTH	50.00	EACH	.	.

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 8

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
1620	22357EN	SUPLEMNTL SUPRT-WELDED WIRE FABRIC	2,500.00	SQFT	.	.
1630	22358EN	FIBERGLASS SPILES-EMBED LGTH-0 TO 20 FT	200.00	LF	.	.
1640	22359EN	SUPPLEMENTAL SUPPORT-STEEL RIB SUPPORT	0.50	TON	.	.
1650	22360EN	SELF DRL RCK DOWEL-EMBED LGTH-0-10 FT	25.00	LF	.	.
1660	22361EN	SELF DRL RCK DOWEL-EMBED LGTH-10-20 FT	25.00	LF	.	.
1670	22362EN	SELF DRL RCK DOWEL-EMBED LGTH-20-30 FT	25.00	LF	.	.
1680	22363NN	SELF DRL RCK DOWEL-END ARCH ASSEMBLY	5.00	EACH	.	.
1690	22364EN	CANOPY TUBES-EMBED LGTH-0-20 FT	50.00	LF	.	.
1700	22365EN	CANOPY TUBES-EMBED LGTH-20-40 FT	80.00	LF	.	.
1710	22366NN	CANOPY TUBES-END ARCH ASSEMBLY	5.00	EACH	.	.
1720	22425NN	TUNNEL SAFETY MONITORING AND TRAINING	1.00	LS	.	.
1730	22426NN	TUNNEL SAFETY EQUIPMENT AND MAINTENANQ	1.00	LS	.	.
1740	22427NN	TUNNEL SURVEY	1.00	LS	.	.
		MISCELLANEOUS			.	.
1750	02570	PROJECT CPM SCHEDULE	1.00	LS	.	.
1760	02572	QUALITY CONTROL	1.00	LS	.	.
1770	20588NC	INSTALL PROJECT IDENTIFICATION SIGNS	3.00	EACH	.	.
1780	22398NN	FORMAL PARTNERING	10,000.00	DOLL	1.0000	10,000.00
1790	22420NN	FURNISH & INSTALL FIELD OFFICE	1.00	LS	.	.
1800	22421NN	PORTAL SECURITY GATE	1.00	LS	.	.
1810	22422NN	TEMPORARY SITE FACILITIES AND CONTROLS	1.00	LS	.	.
1820	22423NN	MONTHLY MAINTENANCE & PROTECTION	1.00	EACH	.	.
1830	22424NN	VISIT TO EXPLORATORY TUNNEL	35.00	EACH	.	.
1840	22438NN	UTILITY BILLS	15,000.00	DOLL	1.0000	15,000.00
		TRAINEES			.	.
1850	02742	TRAINEE PAYMENT REIMBURSEMENT	1,000.00	HOURL	.	.
		TRUCK DRIVER			.	.

TRANSPORTATION CABINET

Department of Highways

FRANKFORT, KY 40622

Sheet No: 9

Contract ID: 07-1226

JEFFERSON COUNTY

NH 265-3 (018)

Letting: 9/07/07

THE BIDDER MUST MAKE THE EXTENSIONS AND ADDITIONS
SHOWING TOTAL AMOUNT BID USING FIGURES ONLY

Item No.	Code No.	Item	Approximate Quantity	Unit	Unit Price Dollars	Amount Dollars
		DEMOBILIZATION &/OR MOBILIZATION			.	.
1860	02568	MOBILIZATION	1.00	LS	.	.
1870	02569	DEMOBILIZATION	1.00	LS	.	.
TOTAL BID						\$.

PART VII
CERTIFICATIONS

PROVISIONS RELATIVE TO SENATE BILL 258 (1994)

During the performance of the contract, the contractor agrees to comply with applicable provisions of:

1. KRS 136 Corporation and Utility Taxes
2. KRS 139 Sale and Use Taxes
3. KRS 141 Income Taxes
4. KRS 337 Wages and Hours
5. KRS 338 Occupational Safety and Health of Employees
6. KRS 341 Unemployment Compensation
7. KRS 342 Workers Compensation

Any final determinations of a violation by the contractor within the previous five (5) years pursuant to the applicable statutes above are revealed as follows:

NON-COLLUSION CERTIFICATION

COMMONWEALTH OF KENTUCKY

COUNTY _____

PROJECT NO. _____

I, _____, _____, under
(Name of officer signing certification) (Title)

penalty of perjury under the laws of the United States, do hereby certify that

(Insert name of Individual, Joint Venture, Co-partnership, or Corporation submitting bid)

its agent, officers or employees have not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding in connection with this proposal.

(Signature)

(Title)

REVISED: 8-23-89

NON-COLLUSION CERTIFICATION

COMMONWEALTH OF KENTUCKY

COUNTY _____

PROJECT NO. _____

I, _____, _____, under
(Name of officer signing certification) (Title)

penalty of perjury under the laws of the United States, do hereby certify that

(Insert name of Individual, Joint Venture, Co-partnership, or Corporation submitting bid)

its agent, officers or employees have not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding in connection with this proposal.

(Signature)

(Title)

REVISED: 8-23-89

CERTIFICATION OF ORGANIZATION(S)

COMMONWEALTH OF KENTUCKY

COUNTY _____

PROJECT NO. _____

I, _____, _____, under penalty
(President or Authorized Official of Bidder) (Title)

perjury under the laws of the United States, do hereby certify that, except as noted below,

(Insert name of individual, Joint Venture, Co-Partnership or Corporation Submitting Bid)

any person associated therewith in the capacity of (owner, partner, director, officer, principal investigator, project director, manager, auditor, or any position involving the Administration of Federal Funds): is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any federal agency; has not been suspended, debarred, voluntarily excluded or determined ineligible by any federal agency within the past 3 years; does not have a proposed debarment pending; and has not been indicted, convicted, or had a civil judgement rendered against (it) by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past 3 years.

Please list below any exceptions to the foregoing, to whom it applies, initiating agency and dates of action.

Exceptions: _____

(Signature)

(Title)

CERTIFICATION OF PERFORMANCE

Certification with regard to the Performance of Previous Contracts or Subcontracts subject to the Equal Opportunity Clause and the filing of Required Reports.

The bidder _____, proposed subcontractor _____, hereby certifies that he has _____, has not _____, participated in a previous contract or subcontract subject to the equal opportunity clause, as required by Executive Orders 10925, 11114, or 11246, and that he has _____, has not _____, filed with the Joint Reporting Committee, the Director of the Office of Federal Contract Compliance, a Federal Government contracting or administering agency, or the Former President's Committee on Equal Employment Opportunity, all reports due under the applicable filing requirements.

(Company)

By: _____

(Title)

Date: _____

NOTE: The above certification is required by the Equal Employment Opportunity Regulations of the Secretary of Labor (41 CFR 60-1.7(b) (1)), and must be submitted by bidders and proposed subcontractors only in connection with the contracts and subcontracts which are subject to the equal opportunity clause. Contracts and subcontracts which are exempt from the equal opportunity clause are set forth in 41 CFR 60-1.5. (Generally only contracts or subcontracts of \$10,000 or under are exempt.)

Currently, Standard Form 100 (EEO-1) is the only report required by the Executive Orders of their implementing regulation.

Proposed prime contractors and subcontractors who have participated in a previous contract or subcontract subject to the Executive Orders and have not filed reports should note that 41 CFR 60-1.7(b) (1) prevents the award of contracts and subcontracts unless such contractor submits a report covering the delinquent period or such other period specified by the Federal Highway Administration or by the Director, Office of Federal Contract Compliance, U.S. Department of Labor.

CERTIFICATION FOR FEDERAL-AID CONTRACT

The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agent.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

This certification is a material representation of fact which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such subrecipients shall certify and disclose accordingly.

(Insert name of Individual, Joint Venture, Co-partnership, or Corporation submitting bid)

(Signature)

(Title)

CERTIFICATION OF BID PROPOSAL / DBE

We (I) propose to furnish all labor, equipment and materials necessary to construct and/or improve the subject project in accordance with the plans, the Transportation Cabinet's Standard Specifications for Road and Bridge Construction, current edition, special provisions, notes applicable to the project as indicated herein and all addenda issued on this project subsequent to purchase of proposal.

We (I) attach a bid proposal guaranty as provided in the special provisions in an amount not less than 5% of the total bid. We agree to execute a contract in accordance with this bid proposal within 15 calendar days after the receipt of the notice of award for the project.

We (I) have examined the site of proposed work, project plans, specifications, special provisions, and notes applicable to the project referred to herein. We understand that the quantities shown herein are estimated quantities subject to increase or decrease as provided in the specifications.

We (I) acknowledge receipt of all addendum(s) (if applicable) and have made the necessary revisions to the bid proposal. We have considered all addendum(s) in the calculation of the submitted bid and applied the updated bid items, which are included.

- No Addendum(s) have been posted

“The bidder certifies that it has secured participation by Disadvantaged Business Enterprises (“DBE”) in the amount of _____ percent of the total value of this contract and that the DBE participation is in compliance with the requirements of 49 CFR 26 and the policies of the Kentucky Transportation Cabinet pertaining to the DBE Program.”

Name of Contracting Firm

BY: _____
Authorized Agent (Signature) Title

Address City State Zip Code

Telephone Number

When two or more organizations bid as a joint venture, enter names of each organization and an authorized agent for each organization must sign above.